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**Pink Salmon  
Product Development Project  
1985-1987**

Boneless-Skinless Blocks and Logs

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## FOREWORD

The Alaska Department of Commerce and Economic Development is pleased to publish the Pink Salmon Product Development Project Report. This 170-page technical document will be a valuable asset to the salmon industry as it increases efforts to successfully produce convenience-style frozen food products.

The development of value-added pink salmon products is not new. When pink prices were low in the mid-1980's the Alaska Department of Commerce and Economic Development undertook the hands-on development of new boneless, skinless frozen pink salmon products. This report is the result of that project conducted between 1985 and 1987.

Interest in those products evaporated when pink salmon prices tripled in 1988. However, after three years of record low prices with no recovery in sight, interest in these convenience-styled frozen products has been renewed. By increasing our product options for the consumer, it is likely we will increase the demand and price for our fish.

This will not be an easy task. In addition to the requirements for consistent price, supply and high quality there are several formidable production problems that must be overcome which are addressed in this report. Unlike whitefish products, salmon are high in oil content making them more vulnerable to rancidity and other shelf-life shortcomings. They are also more susceptible to bruising and other flesh damage caused by improper handling.

This report discusses these and other issues in great detail including labor and production costs, yield and shelf life for different product forms. Great care is taken in recording quality control factors including microbial levels, color, texture, taste, drip loss and binding strength. Lot grading and sanitation efforts are also described as well as pin-bone removal and refrigeration techniques. The report also details the effectiveness of appropriate processing equipment and anti-oxidants. And finally, the report documents market reception of the pink salmon products made from skinless-boneless blocks and logs during the project.

Because there are several processors planning to produce new pink salmon products this year, the Alaska Department of Commerce contracted to have this report written on the project results so that past efforts could be used to the industry's benefit. The department intends to update this report following the 1993 season and will welcome input from all salmon producers of boneless-skinless salmon products.

This report was prepared by Paul Peyton, former fisheries specialist with the Department of Commerce and Economic Development, who oversaw this project. Peyton is now a fisheries consultant and can be reached for answering technical questions regarding the contents of this report at (907) 586-6070.

Copies of the report can be secured by sending \$9 to the Alaska Department of Commerce and Economic Development, Division of Economic Development, P.O. Box 110804, Juneau, Alaska 99811.

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## **Acknowledgements**

I'd like to thank the many people who made this work possible, and apologize to the many whom I fail to mention. This was truly a cooperative effort by many agencies and individuals. In the Department of Commerce, Greg Baker, Karen Tanner, and Dick Reynolds, none of whom is there any longer, and Donna Parker who is and whose support made publishing this report finally possible.

For early guidance on what had already been tried Jerry Babbitt, Jim Barr, Eydfin Tausen, John Lecture and Ken Wong.

Many thanks to the many talented people in the industry who helped produce these products and figure out the problems — the crew at Alaska Fresh Seafoods, especially Dave Woodruff and Matt Moir, the crew at Seafoods from Alaska, especially Roland Schwanke and Gary Ervin, the crew at North Pacific Processors, especially Harmon Blanch and Ken Roemhildt, and the crew at Seafreeze, especially Doug Van Devanter, Danny Delgado, and John McGraw.

For continuing technical and moral support the folks at the National Marine Fisheries Utilization labs in Seattle and Kodiak, especially Herman Groninger and Jerry Babbitt, the folks at the Fisheries Industrial Technology Center, especially Chuck Crapo and Elisa Elliott, and the folks at the Alaska Fisheries Development Foundation, especially Chris Mitchell and Chris Reilly.

For yeoman service in writing and doing a great deal of the detailed production and test marketing work, Harmon Blanch, Doug Van Devanter and Eric Eckholm.

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## Introduction

The Alaska Department of Commerce and Economic Development conducted a multi-year evaluation of alternative pink salmon product forms from late 1984 through mid-1987. The major focus was on application of groundfish processing technology to produce boneless, skinless fillet and mince products that could be either reprocessed or marketed directly.

Two years of test production in 1985 and 1986 were test marketed to major food companies and food service sectors directly by the state, and several processors tried the products through their existing channels.

A number of technical studies focused on the problems of shelf life of the intermediate product forms and microbial and chemical analysis of the products. Educational materials were developed based on filleting experience, sanitation problems encountered, and the need for statistical quality control.

The period immediately following the project was one of rapidly escalating grounds prices and diminishing inventories. These took the oversupply pressure off the salmon industry in Alaska and discouraged food companies seeking stable supplies at relatively low prices. As a result, interest in the work faded and no final report was ever issued.

This report collects and disseminates that information. Most of it is still relevant, though some information on specific hardware is dated. Many companies and individual fishermen evaluating alternative salmon products in the current oversupply environment may find that this information pertinent.

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## **I. EXECUTIVE SUMMARY**

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## EXECUTIVE SUMMARY

The Alaska Department of Commerce and Economic Development undertook a three year effort (1984-1987) to determine methods of adding value to Alaska's pink salmon resource. The results indicate that there are a number of options to increase the value of salmon and to reach markets that are currently interested in utilizing salmon.

The primary focus of this study was the application of technology from the whitefish processing sector to pink salmon and to develop products which might be reprocessed by major food companies for retail development, or produced directly for the American restaurant trade by Alaskan producers.

Price of the raw material is a primary factor in added value production, and the acceptance of pink salmon is related directly to continued large volumes and moderate prices. The intervening years saw a dramatic increase in the price of pink salmon which effectively halted development of new products, followed by a dramatic price decline and renewed interest.

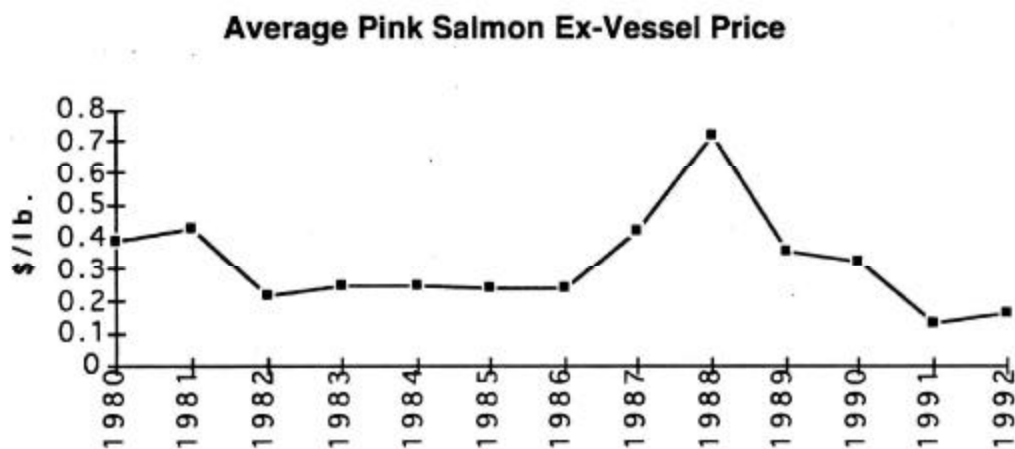
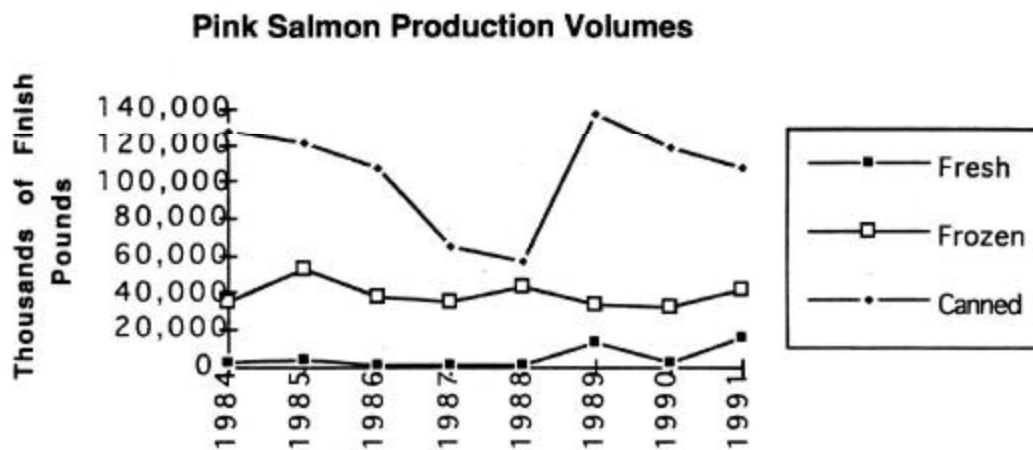
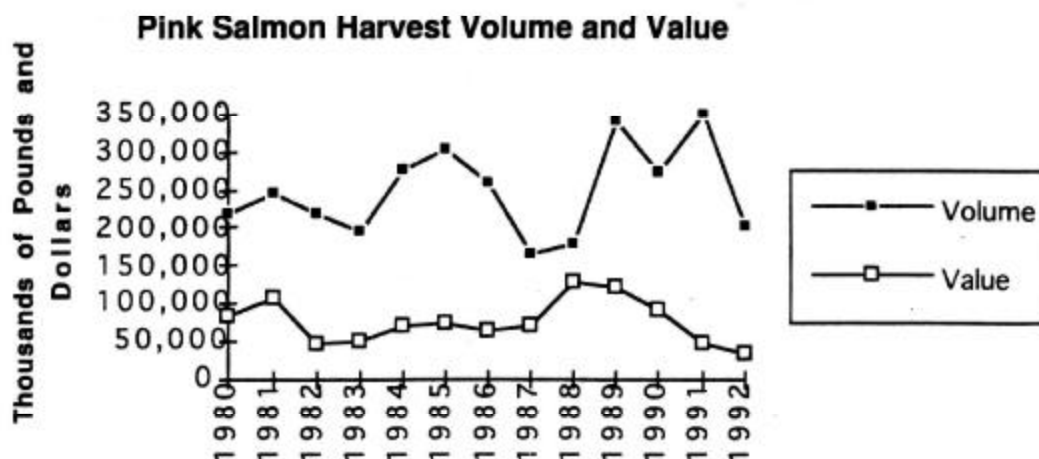
### History of pink salmon production and value in Alaska, 1980-92

Pink salmon represent one of the most abundant resources available in the State of Alaska. They also respond very well to aquaculture programs. Although in the current overproduction situation the value of hatcheries is subject to debate, in the long view they offer the potential for stable production and price that are essential for new product development. Currently ocean ranched pink salmon average 20-40% of the total salmon harvest.

The traditional market for pink salmon is primarily canned. The fresh/frozen market for pink salmon is limited, averaging 40-60 million pounds annually. The frozen market in the Far East has been severely disrupted by the recent introduction of Russian pinks at very low prices. The proportion of pinks frozen peaked in 1985 and 1988, and has been picking up again with the large canned inventories. The volume of pinks marketed fresh has increased dramatically in recent years as well.

When the project began in 1985, inventories of canned pink salmon were very high, and the price of canned pink salmon had been at a relatively low level for several years due to an over-supplied market. By 1987, the surplus of canned pink salmon was depleted, and the value of pink salmon rose substantially. A smaller than anticipated 1987 harvest resulted in a nearly 100% increase in value per pound for pink salmon to Alaskan fishermen. This trend peaked in 1988 with record prices for pinks which effectively stopped further work by the state and drove most new entrants, including Hormel, out of the market altogether.

The situation has reversed since 1988, with inventories at record high levels and prices at record lows. Canned inventories this year declined to the point there is hope the ex-vessel price will recover somewhat, but the situation is ripe for new product development again.



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## Pink Salmon Product Development: Major Milestones

Pink salmon blocks were produced in Kodiak during the first year of test production, 1985. The decision to produce blocks was based upon the standard acceptance of blocks in the seafood industry for cod and pollock. Secondary processors had equipment for reprocessing standard blocks, and the production equipment was readily available.

Blocks were distributed to major food companies such as Gorton's, Van De Kamps and Mrs. Paul's. All of the companies that tested the product expressed interest in further developmental work for pink salmon products. It quickly became apparent that dimensional blocks were not necessary for the product forms that were of interest to the major food companies, and that potential rancidity problems could develop with salmon in block form.

Products for 1986 were vacuum packed logs of skinless, boneless salmon fillets and mince. This was closer to final form needed for reprocessing formed and chunked products and could be portioned directly from the logs for use in food service markets. The vacuum packaging prevented any rancidity problems, and resulted in a product that has proven to maintain quality for at least one year if held in proper cold storage.

The 1986 production was tested again by the major food companies as well as extensive testing in foodservice. It was well received by the foodservice industry, and a potential market for an estimated 15 million pounds of the product was identified, if price and availability remained at around \$0.25 ex-vessel, or \$0.35 delivered to the dock.

No production by the State of Alaska was undertaken since 1987, though several of the Alaskan processors that participated in the test production geared up to commercially produce pink salmon logs. The run up in prices and low volumes in 1987 and 1988 caused some problems for those producers, though several are still producing and have been joined recently by others. Long term potential for pink salmon production looks good for Alaska, and the results of the efforts of the state in product development continue to be of value.

## Production Conclusions

Several questions remain even after five years. The questions group around three core issues. Under each of these there remain some further questions.

1. Is the industry capable of providing salmon at a stable price and volume that warrants the risk of developing products utilizing boneless skinless salmon meat? How much volume is required for a large product introduction and can the industry produce it? Are pink salmon the species of choice?
  - a. The major food companies are probably more cautious now than they were five years ago. Hormel has ceased production of boneless skinless canned product due to price instability. Other companies such as Van de Kamps were bought out during the 80's acquisition binge in the U.S. food industry, and are saddled with substantial debt. At the same time there are new players, such as Tysons.

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Factory trawl companies are hungry for product and could provide substantial mobile filleting and mincing capacity.

- b. Anyone interested is likely to require some form of price and volume stability. The volumes for national distribution can vary from a few million pounds to hundreds of millions depending on the product and market. At present the shorebased Alaska industry can only produce at the low end of this range.

There are two feasible means to assure price and volume are predictable: a group of fishermen working with a processor agree to a long term stable price arrangement for some portion of their production which could be used in developing new markets, or a hatchery enters into a similar agreement. Both are viable, though only the latter has occurred so far (Prince William Sound Aquaculture Corp. agreement with Golden Age Fisheries, for example).

- c. Pink salmon have a low yield per unit of effort due to their small size. Without significant automation, this results in an end product more expensive than chum salmon. Dark chums are another obvious candidate for meat products, and could be produced by hand economically. This is already being done in a number of locations (Silver Lining Seafoods, salmon hams).

- 2. Assuming (1) can be achieved, is the technology there to produce boneless skinless meat products at a price the market can bear? What technologies are they and what is the price? What are the technical solutions to rancidity control, bacterial loads, mince characteristics, quality consistency, etc.

- a. The filleting technology were not sufficiently developed at the time of the original study to produce boneless skinless pink products in volume unless an operator had groundfish processing operation or boneless skinless canned operation to help defray equipment costs. Fillet portions are currently being produced from chums and sockeyes by hand and machine at a number of locations in Seattle and Alaska.
- b. Fresh/frozen product was slightly more desirable than the reprocessed forms although pink salmon stored for three months produced very acceptable blocks. After six months storage, all products were indistinguishable.
- c. Thaw drip increased substantially in the reprocessed products and adversely affected texture and desirability. Thaw drip increased in frozen storage and became unacceptable in the reprocessed products at six months and in the fresh/frozen products at twelve months.
- d. Frozen storage time for both fresh/frozen and reprocessed products should be limited to six months. At twelve months frozen

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storage, all products had deteriorated significantly. This was especially noticeable in the high mince products.

- f. Absent a pinbone puller or automated cutter, the only viable method of removing pin bones is either a V-cut or cutting the whole top of the fillet off. The production runs were too short to evaluate the effectiveness with a trained crew, but there are no producers using V-cuts with pink salmon.

Development of a cost effective pin bone remover is needed. The labor cost associated with hand pin bone removal are estimated at \$0.20 per pound for V-cut fillets to \$0.10 per pound for strip cut, where the fillet is cut into three pieces, and the center pin bone section is minced.

- 3. How can the maximum feasible amount of this activity be encouraged to take place in Alaska? The main limiters are the production quantity achievable in season and the in-state cold storage capacity.
  - a. Few processors have more than a million pounds of capacity. This limits the amount of fish that can reprocessed in state. There is probably a three month window for reprocessing pinks frozen in industry standard manner. Reducing the weight and volume of product shipped south would offset the costs of storage.
  - b. The areas most likely to be able to produce pink salmon meat products are areas with both groundfish resources and salmon, such as Kodiak, or processors who produce other value added salmon products, such as North Pacific Processors.

#### Rancidity Control

One of the most fundamental questions the study sought to answer is the most suitable boneless skinless product form for salmon that would allow the fish to be produced in convenience foods. Salmon is much oilier than whitefish and therefore must be protected from rancidity development as well as dehydration and other frozen storage problems. The oil also tends to migrate to the surface if the fish is subjected to serious temperature fluctuations. These considerations strongly affect the possible product forms.

Rancidity control can be approached through chemically blocking the chain reaction that is necessary for the effects to become noticeable, or through excluding oxygen, which reacts with the oil to produce the objectionable compounds. Both methods were tried, using antioxidants in traditional block products and vacuum packaging the logs in barrier films. The blocks can be vacuum packaged also, but the shape makes broken bags and a loose fit more likely.

Packaging method, antioxidant treatment and skinning depth all contributed to better product quality during frozen storage. Frozen storage time for these products should be limited to seven months. At fourteen months, all products were unacceptable.

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## Product Form

The results based solely on rancidity and ease of packaging favor the log product. A void free product of easily controlled weight that is freezer stable for at least a year is relatively easy to produce. The product can be plate or blast frozen, and if seal integrity is assured, can even be brine frozen.

The log will generally freeze slower, however, due to its greater thickness, 3+" compared to 2+" for blocks. Most producers do not have plate freezers, and blast freezing logs produced an inferior product compared to plate frozen blocks. The difference was marginal in fillets, but caused a noticeable texture difference in mince.

Other considerations are ease of use of the finished product. The outcome here is split, as the reprocessing industry varies in the types of equipment used. Traditionally, block products were cut into sticks and rectangles or wedges. Clearly, the log product cannot be used to produce sticks, but no company contacted anticipated using the relatively expensive salmon fillets for such a product. There is some interest in the mince for sticks.

Recently the move has been to more natural shapes, either stamped out as nuggets or fillet shapes using a machine like a cookie cutter (Koppens, Formax), or compressing a block into a log shape with a fillet cross section, then slicing (Becher press). The log product can be used for either, but has an advantage in the latter as less deformation is needed to shape the log compared to a rectangular block. This leads to less change in texture.

The response was favorable for both product forms depending on the end product envisioned. The log did work well in the Becher press as envisioned and held up for at least one year. The blocks made with antioxidants did hold up well for a minimum of six months, though some companies do not want any additives in their products.

The logs were of particular interest to smaller operators interested in doing their own reprocessing into foodservice or consumer ready products. At least two operations were interested in this business approach during the 1987 season, but the small size of the pink run and the high prices combined to delay commercial startup.

Drawbacks to the logs are that they require specialized vacuum extruding equipment, which would be of interest for making sausages and jerky products, but probably would be rather specialized for most seafood operations. Some boneless skinless canning operations use pumps to feed product to the can filler, and these can be fitted with vacuum chambers and used to extrude logs.

One of the biggest drawbacks is the unorthodox nature of the product -- operators and buyers simply aren't familiar with the form. Several efforts have been made using similar products made from pollock. Eventually the form will probably find more acceptance, particularly for mince forms.

## Fillet Production Methods

Hand Filleting. The benefits of this method are low capital cost, maximum flexibility, generally lower defect rates compared to machine methods, higher

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yields, and fewer sanitation problems. Probably most significant is that with a skilled crew, the filleter can adapt to each fish and produce a higher yield and better cut than is possible with a machine that must be set for the "average" fish. Sanitation consists of cleaning the knife and worksurfaces, an obvious advantage compared to disassembling and cleaning a mechanical filleter.

Drawbacks are the lack of skilled labor in most areas due to the seasonal nature of the industry, and the large space requirements for volume production. The only operation that has used hand filleters on a large scale is Prince Rupert Fishermen's Coop, which has a large skilled workforce that primarily cuts flatfish. They can, however, produce 50,000 lb of pink fillets in a shift if so desired, which is fully comparable to a sizable mechanized operation.

Baader 184/185. The 184 is designed for fish under 4 lb., and seems particularly well suited for pink salmon, while the 185 is designed for larger fish and can handle most salmon. Both machines require headed and gutted fish and were designed primarily for cod, which have heavier bones.

These machines have proven reliable and efficient for filleting pink salmon in large production runs at Seafreeze, Icicle, and North Pacific Processors.

Baader 200. The Baader 200 is a further development of the 185 in that it was specifically adapted to fillet salmon. It is designed for fish weighing between 3-14 lbs. It too requires headed and gutted fish and can handle approximately 30 salmon per minute.

Baader 212. (This machine was not available at the time this project was conducted, but would probably be an important piece of equipment in any large scale production of pink blocks.) This machine was designed for pollock but works effectively on pinks weighing less than 3.5 lbs. Only two crew are required to operate this machine which takes fish in the round, heads, guts, removes the roe, and fillets the fish before automatically transferring it to a Baader 52 skinner which can produce either a conventional or deep-skinned product. It handles 110 fish per minute. While adjustment problems were reported with its limited use on salmon last year, it will be put to the full test this season producing approximately 54 tons of pink fillets per day in Prince William Sound.

Mechanical Pin Bone Removal. Unfortunately this machine has yet to be developed. However, there are at least four companies working in earnest to solve this problem which is probably the most serious impediment to cost-effective production of boneless salmon products.

#### Mince Production Methods

The standard production methods for separating meat from bones force the meat through openings too small for bones to pass through. Depending on the equipment used, the resulting product is either hamburger-like in texture, or much finer, like a pate.

The most widely used and cheapest mince equipment is based on perforated drum and belt, which turn in the same direction at the same speed and squeeze the meat between them. The holes in the drum allow the meat to pass into the

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interior, while the bones remain on the outside where they are scraped off and discarded. The mince is augured out and recovered. Obviously, the size of the holes in the drum affect the texture, and also the number of bones that pass through. Standard sizes are 3-5 mm, which result in a low bone content and approximately hamburger texture. This processing technology is widely used in whitefish processing, both to recover flesh from trimmings and as a major processing step in the production of surimi.

Coarse mince can be an attractive product if produced from clean, relatively dry trimmings and frozen quickly. Too much water used in processing can cause problems, and the product texture can become mealy if frozen slowly or with too much water. The product binds well when cooked.

An alternative method adds a refining step, where the mince is forced through a fine sieve. This removes any impurities such as the occasional bone and flecks of blood or skin that might have passed through the perforated drum. It also reduces the speed of processing to about one third, while increasing the cost of the equipment by a factor of three times.

The fine mince can be produced from lower quality trimmings, including those with small pieces of skin or bone attached. Moisture content is much less a problem than with the perforated drum deboner. Due to production speed and high cost, the fish must be fairly valuable to justify the expense.

Perforated Drum Deboners. The major manufacturers are the West Germans (Baader) and the Japanese (Bibun, Yanagiya, etc.) The German equipment has been used primarily for cod, while the Japanese equipment is used primarily for pollock and surimi. Both perform well, producing equivalent products.

The major differences are cost and ease of cleaning. The Japanese equipment is often made using mild steel and brass, is generally not designed to be disassembled and cleaned easily, and is intended for continuous operation. It is also about one third less expensive for equivalent throughput. The Baader deboners are all stainless steel, and strip easily for cleaning. There are fewer sizes to choose from, however, and they are considerably more expensive.

Strainers and refiners. Two types of deboner designed by Rae McFarland, former President of Beehive were tested. The first is produced by Beehive, the second by McFarland after leaving Beehive. The second design produces a longer fiber length, for a coarser texture that binds on cooking into a more pleasing texture. The first machine produced a very fine paste with the consistency of baby food. Both machines produced a high quality mince. Other companies such as Paoli make deboners designed for beef and chicken, which may be suitable, or may use too much pressure.

#### Market Testing

Salmon Processors. Quite a bit of the product and interest in the end ended up going to Alaskan processors who have secondary processing and marketing operations, principally Seattle Seafoods/Ocean Beauty and Peter Pan Seafoods. Both were still interested at the end of the project. North Pacific Processors continues to produce boneless skinless products to this day. A number of other

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processors are also producing fillet products, principally Kodiak and at-sea processors.

Food Service. New product forms were tested in a state funded study conducted by Pacific Communication and Marketing. Two products were tested, a frozen, boneless, skinless fillet-steak, and frozen minced salmon patty, both of which can be portioned for exact weights.

Product concepts developed and tested included breaded and battered fillet-steaks and patties, plain steaks and patties, and boil-in-bag products in sauce.

The market testing included a sampling/questionnaire effort at a foodservice trade show resulting in 150 finished surveys, five direct market tests in Minneapolis, Portland, Austin, Lake Tahoe and San Diego and a focus group of foodservice professionals in Seattle.

The results clearly show a market for the product, within specific markets and at a moderate price point. The product was well received, and especially perceived as an appropriate product for outlets which do not specialize in seafood as a seafood entree.

The fillet product was far preferred to the minced product for texture, taste and moisture. The ability to achieve exact portion control, the lack of skin and bones and the good flavor were strong positives. The re-formed look which was not "fishy," the dryness of the minced product and the estimated price presented areas of concern.

Based upon assumptions developed through this project, there is a possible new-product market which could utilize approximately 15 million pounds of Alaska's annual pink salmon harvest, selling for a wholesale price of approximately \$2.45/lb. for the fillet steaks and \$1.42/lb. for the minced salmon.

The U.S. foodservice market consumes approximately two-thirds of the seafood used in America. Households spend an average of \$30/week on food away from home. The foodservice industry offers a good test opportunity because it is relatively easy to target potential segments of the market, and food professionals are responsible for testing and preparing the product, allowing for greater control over preparation and the ability to test without the added expense of consumer packaging.

Retail/Majors. Most of the work done with major food companies needs to be followed up to be of value. Notes from various contacts with the companies are contained in the appendix. The following summaries highlight some of the major contacts made.

Gortons. The principal contact with the company retired, and at last word the parent company, General Mills, was interested in the product but had questions about price and availability. They evaluated the block product and said it was quite good, comparing well to Norwegian products from farmed Atlantics.

Van De Kamps. The company was acquired by Pillsbury toward the end of the project, and buying was consolidated at corporate headquarters. The principal contact left the company several years ago, and the trail appears cold.

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However, this company was the most interested at one time. They use a Becher press to form a log from which fillet shapes are sliced. This form is ideally suited for the log product, and initial tests indicated the product worked very well.

Certi-Fresh/Gallati Brothers. This company was also purchased part way through the project. They are very interested in formed products, and were one of the first to invest in a Koppens former, for which the log product works quite well.

Mrs. Paul's Kitchens. At last contact the company was quite excited about using the fillet log product to produce chunk meat for various stuffed products.

### ***Conclusions***

It is the intention of the Department of Commerce and Economic Development and myself to follow up this effort with an update following the 1993 salmon season. I hope you find this of value in its present form.

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## II. PRODUCTION METHODOLOGY

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## **PRODUCTION METHODOLOGY**

### **REVIEW OF 1985 PRODUCTION EQUIPMENT USED AND HANDLING PROCEDURES**

#### **Fish Handling and Unloading.**

Kodiak was the site of the project, and the decision was made early that fish suspended in chilled seawater from time of capture would probably be necessary for adequate firmness and lack of bruises. Therefore, only seine fish were used, though slush iced gillnet fish might yield adequate results. Gillnet fish would almost certainly require more trimming and would give lower yields due to net marking.

Fish held for more than a day after rigor passed were noticeably softer than fish processed as they came out of rigor, and were generally not accepted for the very high quality product produced during the experiment, except as mince. Control over holding temperatures varied, with considerable icing required to hold the fish in aluminum totes outside until they were out of rigor. No effort was made to quantify this relationship.

#### **Heading and Filleting.**

After fish came out of rigor, they were headed using a Coastline pneumatic heading machine. The anal fins were then cut off as the fillet machine frequently jammed on these fins. The fish was then cleaned and filleted in a single operation using a La Pine fillet machine (Model 240D), a machine designed for lake trout.

During the entire season, this machine had the wrong saddle in it, one designed for rockfish. The differing body geometry of the salmon may, in part, explain the erratic rib bone removal experienced. The belly bones were removed by hand at first, but after some adjustment the machine became more consistent, removing the majority of the ribs but occasionally leaving all the rib bone tips in the belly flap. In the end, the fillets were simply J-cut to avoid these hard-to-spot defects.

The yield was also poor compared to more expensive equipment such as the Baader 184/185 series. The machine did work reasonably well with fish under three pounds, as far as rib bone removal was concerned, though yields were still poor.

#### **Collar and Rib Removal.**

A crew of five was generally required to remove the belly bones or belly flaps prior to deep skinning, adding approximately 17% to the overall labor cost that was not anticipated. The removal of the belly flaps during later runs also drastically affected yields. This was necessary, however, to get adequate quality product before the season ended.

Also removed at this step were collars and fins. Clearly, for use on a Baader 184/185 line which requires dressed fish with the collar removed, an iron chink with roe extractor could be used in lieu of heading, gutting, and collar and fin removal by hand. Alternatively heading and collar removal equipment for cod can be used.

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### Skinning.

A Baader Model 50 skinner was used. This machine is an older unit designed for flatfish, using essentially a horizontal bandsaw setup with a band knife rather than a saw blade. The head is adjustable for depth of cut, from shaving just the skin off to slicing about 1/2 inch off. The knife needed sharpening, using a rotary stone attachment, every two hours.

Mechanical, spring loaded fingers press the fillet flat against a moving rubber traction belt. The fillet is pushed/drawn over the knife and exits down a chain-link belt. There is a considerable range of adjustment on the machine, and the operator never felt that the optimum set of conditions was reached. The machine is fairly sensitive to fillet firmness, and seems to take an excessive amount out of the thick part of the fillet in order to remove the heavy fat deposits near the tail. Comparisons with the Baader 47 and Trio skinner would be in order. Baader has since developed the Baader 52 capable of deep and conventional skinning.

The entire fat layer was removed except for that V-shaped portion under the lateral line. This extends most of the way through the fillet and would require a V-cut to remove. This would obviously leave four strips of expensive meat and little yield. The resulting dark colored meat is apparent in the end product, and could potentially cause rancidity problems. This is the primary reason vacuum packaging is considered necessary. Whether consumers will object to the dark streak or not is not known at this time.

### Pin Bone Removal and Trimming.

Pin bones were removed using a V-cut, considered standard for fillet block product. Lack of skilled crew was most apparent here. With only 8,000 pounds of production, skills were never developed to adequate levels. Throughput averaged less than ten pounds per hour per trimmer, compared to 50-100 pounds per hour per skilled worker for high quality cod work of similar nature. Few parasites were observed, though no particular effort was made to look for them.

As the products eventually made from these fillets will be reformed or chunked, it is now obvious that V-cutting the fillets is unnecessary. It is recommended that the fillets be cut into two or three pieces, with the pin bone section recovered as mince. This should pick up the speed of pin bone removal markedly, perhaps to the 100+ pounds per hour rate for skilled workers. The mince can be recovered, and probably mixed with the fillets and sold for the fillet price.

Pin bone trimmings, soft or pale fillets, and other useable material was separated from fat, bruises, bones, and other defects by the trimmers. The good portion was collected for mincing, the remainder discarded. Bruises larger than the size of a quarter were trimmed out. Blood is known to catalyze rancidity, as well as being unsightly and frequently detectable by taste. Many fillets had minute bruises scattered throughout the fillet of unknown origin, but these were left in.

Two people were required from a trimming crew size of nine to inspect and rework every fillet. These were the most skilled workers, leading to very slow throughput. This proved essential, however, to avoid defects in the blocks. It is highly recommended that all fillets be inspected before packing.

### Antioxidant.

Filletts and trim were dipped in an aqueous solution of 3% sodium erythorbate by weight and 0.1% citric acid by weight (citric acid to yield pH 5.6). The filletts were placed about 10-15 pounds per egg basket, dipped by hand for 12-15 seconds and placed on rack to drain for ten minutes. The solution was mixed in 25 gallon batches and changed after 500-750 pounds. The pH and microbe count were still good at this point, but the solution was getting bloody and objectionable in appearance. Small quantities of ice were kept in the solution at all times to maintain the temperature at 33-35° F.

Sodium erythorbate has been used successfully on a number of oily fishes. It is the stereo isomer of ascorbate, the salt of vitamin C. Chemical properties are similar between the two isomers, but erythorbate costs about \$3 per pound, while ascorbate costs about \$5. Note that the price of the dip is rather steep, with 12 pounds of sodium erythorbate used per 500-750 pounds of fish, at \$0.05-0.07 per pound and an effective addition rate of 1.6 to 2.4%. It is quite possible that lower concentrations would have yielded satisfactory results, but no definitive work has been done on this. In conjunction with vacuum packaging, a 1% addition rate should be adequate, for a cost of \$.03 per pound.

### Mincing.

A Baader Model 694 perforated drum deboner with five millimeter hole size was used. This is generally recognized as the best compromise between retaining texture and minimizing bone content. This product has the texture of hamburger, and can be used for anything canned salmon is used for -croquets, loaves, burgers, salads (after cooking), and so on. If fresh fish is used, it binds quite well even after freezing. Smaller hole sizes and red meat and poultry deboners tend to yield fish paste of more limited applications.

### Packing.

The product was packed in standard 18.5 pound blocks using a Beck double frame with aluminum top and bottom pans originally brought in by North Star, a defunct east coast based bottomfish operation that operated at the Swiftsure plant in Kodiak. These were borrowed from International Seafoods of Alaska. Dimpled waxed block cartons and masters were obtained from the also defunct Alaska Foods Plant at Gibson Cove. The drained filletts or mince were weighed out into baskets, then packed. Filletts were packed long style, skin down, as is standard. A better method would be skin in, to protect the remaining fat from rancidity. To obtain full corners, it was necessary to overfill with 19.0 pounds. While removing the voids this resulted in excessive crown. Mince was simply dumped in and leveled by hand.

### Temperature Determinations.

Temperature determinations were run on Lot 23485A which produced minced salmon on August 21, 1985. These were layer iced fish from the VIXEN and the LEFT CAPE. They were approximately 36 hours old and were held in slush ice after delivery.

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Tote waiting to go to header, no ice	37° F
Heading table	39
Fillet trimming table	44
Pin bone table	46-48
Skinner	48
Pin bone trim	51-53
Mince, packing table	53

Improvements to speed flow of product are certainly possible, as this line was not continuous and depended on moving baskets of material around. There was also some problem keeping the flow smoothed out, as pin bone removal was the slowest step. Product tended to stack up there and sit waiting.

#### Freezing.

A Dole hydraulic plate freezer of 3,000 pound nominal capacity was used. Four double frames per shelf were used, yielding a 1,824 pound actual capacity. This was never fully utilized due to slower production. Pressure was approximately ten pounds per square inch on the block.

Frames were stockpiled in an idle blast freezer and loaded every two hours to minimize draining. It would probably have helped eliminate voids if they could have been placed in an empty plate freezer and been squeezed prior to freezing. The hydraulic plate freezer was very efficient, though seldom was its capacity taxed.

#### Yields and Crew Requirements.

Please refer to the appropriate tables for figures on labor costs and yields throughout the discussion. The bulk of the production took place between August 14-23, on the tail of the pink peak. Due to the configuration of Alaska Fresh's plant and the crew size, production during the peak was not feasible.

# **PINK SALMON YIELD TABLE**

Round weight basis

<u>STEP</u>	<u>Hand</u> <u>Operated</u>	<u>Midpoint</u> <u>B. 184/185</u>	<u>LaPine</u>	<u>Yield Est.</u>	<u>% Drop</u>
H & G	75%	na	na	75	25
Fillet	65-67**	na	56-60	65	8-10
BB and collars	54-56	52-54	45-48	53	12-15
Skin Shal	na	45-47	na	46	7-8
Pin out	43	40	na	41	4-7
B flaps off*	32-36				7-11*
Skin Deep	na	na	38	41	4-6
Pin out	na	na	32	36	4-7
B flaps off*	28-30(est)				7-11*
Trim	na	na	25-30	34	1-3
Mince recovery					4-6

\* Hand fillet at PRFC with belly flaps removed, 36% skin off, pin bone in, shallow skin. Belly flap removal would lower yield 7-11 points in addition to pin bone removal.

\*\* Planked dark chums, Jerry Babbitt.

The yield data for other fillet methods is an amalgamation from many different sources, but seems to be fairly consistent. Wherever possible, large production runs were used as opposed to small test batches. Entries under the various methods are actual data points unless noted otherwise. The last two columns are derived. The "Midpoint Yield Est." column represents a midpoint yield estimate under production conditions using good fillet equipment and a trained crew working with good chilled seawater fish. There is some loss of fish due to bruises and soft fillets that shows up in the trim heading. Overall yields should be around 34-36% with an additional 4-5% mince from good trimmings.

Product was moved between processing steps in baskets. Belt feed and linear flow would have eliminated several crew members and lessened hand contact with the fillets. Bottlenecks frequently developed at the trimming table due to lack of skilled people, and the fillet machine could produce about twice the product the rest of the line could handle, though the skinner was never taxed unless it broke down.

The loss of recovery is additive as you move down the table. Within a subgroup, such as shallow skinned, the added processing steps result in added yield loss. In going from shallow skinned to deep skinned, there is an additional 4-7% loss.

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Pin bone or belly flap removal would deduct an added 4-7 and 7-11 percentage points respectively.

## **REVIEW OF 1986 PRODUCTION PRODUCTION RUNS FOR AFDF/CRAPO STABILITY STUDIES**

Approximately 2000 pounds of round fresh pinks from Alaska Fresh Seafoods were processed at All Alaskan and the National Marine Fisheries Service (NMFS) lab at Gibson Cove. For a complete description of these tests refer to Chuck Crapo's report in Section IV, Product Evaluation and Testing.

### **EXPERIMENTAL AND PRODUCTION RUNS AT SEAFOODS FROM ALASKA**

After putting the samples up in Kodiak, Chuck Crapo, the Marine Advisory Program quality expert and I traveled to Kenai on August 11 and 12th to put up fillet log products. We took along the Baader 50 skinner for deep skinning and spent about one week in Sterling, near Kenai, at the Seafoods From Alaska plant before going to Cordova for the major production run at North Pacific Processors.

The week at Seafoods was spent running yield tests using a skilled fillet crew and putting up vacuum extruded logs using a Vemag extruder. A total of 1200 pounds of mince and fillet logs were produced. Samples were shipped to Kodiak for evaluation and storage life tests, and the remainder was shipped to Seattle for test marketing.

8/13/86

- Equipment set up.
- Trimming and preparing salmon fillets.
- Crew filleting and trimming.
- Pink salmon history:  
fish were caught 8/12/86 at Cook Inlet set net site; immediately iced at the site until picked up; iced and held in 600 pound totes in a cool room until processed.

8/14/86

- Continued filleting and trimming. Trimming was done using a one-cut method separating the pin bones from the rest of the fillet. Finished product put in 60-8-pound containers and held in cool room until used.
- Finished product has considerable pin bone content and was rechecked.
- Run lab sample logs in 4.0 inch casings (continuous casings).
- Mince and salt addition test samples were prepared using a paddle mixer. Mixing time was determined at one minute for thorough mixing of the salt and coating of the fillets.
- Samples were to be shipped to Kodiak for storage trials and chemical analysis.
- Minced product was prepared using the Yanagiya with 5mm drum. Machine provided good particulate size and texture.

Yields from round fish are as follows:

<u>Operation</u>	<u>Top Cut</u>	<u>V-Cut</u>
H&G	75%	75%
Fillet	55	55
Deep Skin	43	43
Boneless Cut	24	36
Pin bone Trim	16	6
Unuseable Trim	3	1
Useable Yield	40	42
Pin-trim/fillet	40	14

We also tried several mince and salt addition rates to determine their effect on texture, binding and visual appeal. Logs of 4" diameter were used for these experimental runs.

<u>Salt Levels</u>	<u>Mince Levels</u>				
	<u>0%</u>	<u>15%</u>	<u>30%</u>	<u>15%</u> (washed)	<u>00%</u>
0.0%	X	X	X	X	X
0.5%	X	X	X		
1.0%	X	X	X	X	X

We decided to run a larger test batch at NPP using the superior mixer there (a ribbon blender), as the coating of mince on the fillets and elimination of obvious mince pockets should be superior to that achieved at Seafoods using a paddle mixer.

Next we determined the optimum diameter casing, choosing a 6.5" flat width as the best compromise. This will mimic one-half a 16.5 lb. fish block while also yielding a 4-8 oz. steak of suitable thickness (1/4-1/2") at 8.25 or 10 lb. net weight. Unfortunately, 6.5" is not a standard size casing, requiring large special orders and six week delivery time. To circumvent the problem we sealed 7 1/2" casings using the heat bar on a vacuum packer and also sewed some with thread. Sewing was slower, but proved less prone to blowing out as the log was extruded. Approximately half the production was put up using the modified 6.5" casings.

8/15/86 Sterling

- Production run of fillets and mince products using V-Mag vacuum stuffer.
- Production in 6.5 and 7.5 inch casings (Cryovac).
- 6.5 inch casing prepared by sewing 1 inch off the larger size with commercial sewing machine. These casings held up well in production.
- Four product forms produced as follows:

% mince	% salt,	size casing
15%	0.5%	6.5
0%	0%	6.5
0%	0%	7.5
100%	0%	7.5

- Production line on the 15% mince used a paddle mixer that abused the fillets and tore them up. There was a significant reduction in the texture of that product. Mixing time was only 1 minute to assure thorough mixing of the salt and coating of the fillets with the mince. All other forms were metered directly into the vacuum stuffer.
- V-Mag appeared to reduce fillet particle size somewhat due to the augers used to convey the product to the horn.
- Production of approximately 1,200 pounds of product in three hours of operation.
- Product was blast frozen for shipment to Seattle.
- Comments: The mixer was not ideal for preparing the mince/fillet mixture. It tore the fillets up and made them less recognizable in the final product. The stuffer worked well although it appeared there was some destruction of fillet quality caused by the augers. Pockets of mince were seen in some of the mixed product.

## NORTH PACIFIC PROCESSORS

Following completion of the Seafoods from Alaska production, Chuck and I traveled to Cordova with the Baader 50 skinner for test runs at North Pacific Processors. NPP was then producing the Hormel boneless skinless canned product, and had a substantial filleting operation.

The production took place over the space of about 1 1/2 days in late August. PWS only produced about 12 million fish out of the predicted 28 million return that year. Most of the fish turned up late, with consequent pressure on NPP to fill various contracts. The result was that the project was pushed back to August 20 and August 24. Four major products were produced: Beehive mince logs, fillet logs, Bibun mince logs, and combination logs.

8/20/86 Cordova. Examined the Bibun and Beehive mincers and waste streams being fed into them. The Beehive mince is very fine, basically has no texture. It is possible to control the moisture content, however, and clean up material with lots of dark skin in it that would result in black spots in Bibun mince. We decided to take about 1,000 lbs. of Beehive mince for evaluation, using the same input material as the Bibun.

The Bibun was equipped with a 5mm hole size drum, which produced a mince with the texture of hamburger. While the texture was better than with the Beehive, the material used had to be much cleaner to achieve uniform color, and

the waste streams transported using water chutes was very wet, yielding a mince that is probably too high in moisture for direct use as a patty.

After examining the minces produced from the various waste streams, we determined that the Bibun source would need to be the bellies cut from fish being fed into the 184 line and top cut from fillet removing the pin bones. Belly cut removed the pectoral fins in a large cut to produce a product similar to the 195's which were set to remove the bottoms of the belly flaps.

8/20/84. Production day using pink salmon from West PWS. Product quality was fair. There were considerable bruises and soft fish in the load. Product was sorted from the indexer to the filleter, a Baader 195 which gives lower yields than the current state of the art 184. Next, the Baader Model 50 skinner was used to deep skin. Two people were required to flip the fillets over as they exited the 195 to present them to the 50 head first.

The pin bones were removed using a top cut. The top cuts and fillets were placed on separate moving belts and the fillets stockpiled in plastic tubs until their turn through the stuffer. The trimming line worked very slowly, not achieving the 50 lb/hr target.

Top cuts and belly flaps were minced using the Bibun. Alternately, mince and fillets were packaged. The combination logs were mixed using the ribbon mixer, while other product was loaded directly into the screw conveyor for transport to the stuffer hopper.

The product was stuffed into standard 7.5x28 Multivac barrier film sausage casings and clipped with standard metal clips. Some bags were sewn using a regular sewing machine to reduce the width from 7.5 to 6.5 inches. This size gives a 4 oz steak 3/8" thick, suitable for breading and deep frying, or cooking without coating. The 7.5" casing yields a 6 oz. steak, unbreaded.

A 4" diameter horn with a foot activated pneumatic cut-off valve was used which fitted the rest of the line well, but the horn size proved overlarge for easy control of the casing. The stuffer worked well, but, without vacuum assistance, there were small voids in the product that became apparent after freezing and cutting.

A standard clipper was used to secure the end of the casing after patching to target weight. Obviously, having a portioner on the pump would have made getting even weights much easier and more efficient. The stuffed product was laid on freezer racks for blast freezing but ended up in the aisle of the shelf freezer, which led to slow freezing and high drip loss.

Several problems associated with the production set-up became obvious, but, due to space and time constraints, could not be addressed. These centered on lack of space for trimming and inspection, the lack of qualified inspectors and the lack of refrigerated holding space for stockpiled product.

Three product forms were produced, with the first two in both 6.5 and 7.5" casings. The combination was packed in 7.5" casings.

- 100% mince
- 100% fillet
- 15% mince, 0.5% salt

Approximate production:

- mince (6.5) 145 @ 8.25 = 1,232.5 pounds

- mince	(7.5) 58 @ 11.50 = 667.0
- 15% mince	(7.5) 43 @ 11.50 = 494.5
- fillets	(6.5) 58 @ 8.25 = 478.5
- fillets	(7.5) 158 @ 11.50 = 1,817.0
Production time and staffing:	
Stuffing time	- 2.5 hours
Filleting time	- 10 hours
Mincing time	- 3 hours
Staffing	- 195 feeder (1)
	50 feeders (1.5)
	trimmers (6) (11 for 3 hours)
	handlers (3) (5 for 3 hours) Handlers
removed product from belt, iced it down, etc.	
	mincers (3)
	stuffers (5)

Retraining the crew at the end of the season following a grueling two weeks of 16-18 hour days proved difficult, as did finding graders capable of spotting errant pin bones. Defect rates were marginally acceptable most of the time, worse at the start and better at the finish. Space was not available for the number of trimmers required to do the top cut unless the other fillet lines were shut down.

8/24/86 Cordova. Production used hatchery fish from Port San Juan. Good quality fish, good meat color, mostly firm flesh. Some pale fillets were graded out. This would show up as high mince yield.

Production of both Beehive and Bibun minces. Beehive mince had excellent color and very fine texture. It was noted that the Beehive mince probably made the ideal coating for a mince/fillet product. When changing production from mince to fillet, it took over 75 pounds of fillets to clear the Beehive mince from the horn whereas the Bibun mince cleared in about 30. The product produced had mince well mixed in the fillets. The Beehive mince being very fine mixed easily and coated the fillets very well. Much better than the Baader, Yanagiya or Bibun minces that we worked with elsewhere. From this it can be concluded that the Beehive could have a place cleaning up waste streams that are high in skin and water content for use in producing a combination log product.

Casings were sealed in a multivac unit to get to 6.5 inch size. These casings failed much more often than the sewn cases. Of the 250 cases produced, between 30 and 40 casings blew out. Production in both 6.5 inch (8.25 pounds) and 7.5 inch (11.5 pounds) casings.

Approximate production:	
- mince	(7.5) 291 @ 11.50 = 3,346.5 pounds
	Bibun 226 2,599.0
	BHive 65 748.0
- fillets	(6.5) 142 @ 8.25 = 1,171.5
- fillets	(7.5) 210 @ 11.50 = 2,415.0
- mix	(6.5) 19 @ 8.25 = 157.0
- mix	(7.5) 8 @ 11.50 = 92.0
Production time and staffing:	
Stuffing time	- 4.5 hours
Filleting time	- 9 hours
Mincing time	- 5 hours

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Staffing	-	195 feeder (2)
		50 feeders (2)
		trimmers (14)
		handlers (5)
		mincers (3)
		stuffing (4)

Poor pin bone removal caused the last 90 minutes to be used to rework the product.

Approximate recoveries:

48% from the Baader 195

40% at the Baader 50

23-25% recovery as fillets

15-18% recovery as mince

QC Examinations

drained weights

defects

color

cooked texture

All samples exhibited good color. There were a few small dot spots in the mince but these were not noticeable. The cooked texture of all products was good. The mince held the log together well. The fillet product also held together, but not as well as the mince and mince/ fillet mixtures.

Comments: Production was faster than the previous day, but much of the workmanship was sloppy. Initial pin bone removal efficiency was good, but changes in trimmer personnel were made to speed production about half way through the day. The new crew members were shown an incorrect cut leading to a defect rate of about 10%. Over 1,000 lbs. of fillets had to be reworked as the graders did not pick up the problem. This, plus the excessive handling, contributed to the high microbial levels in the product. Set up between the 195 and 50 required that the fillets be reoriented to get good skinning and this took two people handling the product unnecessarily. Frozen product looked very good with an oval shape approximately like formed beefsteaks.

8/25/86 Cordova. Took microbial samples from 8/24 and 8/20 production for analysis in Kodiak. Samples were taken from each period of production to get a representative sample.

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### III. PRODUCT EVALUATION AND TESTING

**1984 BUYERS' STANDARDS  
Pollock Blocks**

<b>DEFECTS</b>	<b>Gorton's</b>	<b>Van de Kamp's</b>	<b>Mrs. Paul's</b>
<b>Fillet Size</b>	24 oz. max, no folds	< 2 oz. 20% max. 2-4 oz., 40% max. > 4 oz., 40% min.	No standard
<b>Bruises</b>	<10% slight	0	0
<b>Blemishes</b>	2 each, < 1"sq. tot	0	<1/4 in. sq. skin <1/2 in. sq. belly skin max
<b>Bones</b>	0 (1-3?)	0 TOTAL: < 5/block	<u>3/block</u>
<b>Parasites</b>	0 (1-3?)	Only white or translucent, < 1/4", 1/block	0
<b>Pack</b>	Long, skin down	Long	Long, skin down
<b>Voids</b>	< 1/8" deep, < 3/4" dia.	< 1/4 inch cubed	
<b>Dim. Tolerance</b>	±1/16 inch	±1/16 inch	±1/8 inch

<b>BACTERIOLOGICAL STANDARDS</b>			
Total Plate Count	100,000/g	100,000/g	100,000/g
Coliform	100/g	(staph 10/g)	100/g
E. coli	0	20/100 g	0
Salmonella	0	0	0
Other	0		
<b>Antioxidants</b>	Must be FDA approved	3-5's dip in 3% TPP	None allowed
<b>Contaminants</b>	0 0	Mercury - < 1 ppm PCB's - < 5 ppm	0 0
<b>Drip Loss</b>	No standard	No standard	Less than 7%

## **PRODUCT EVALUATION AND TESTING**

### **1985 PRODUCTION LOT GRADING**

Each day's production was broken down into lots by boat and time of day. The lots were graded according to modified USDC Grade standards for pollock blocks (see attachment). The major changes were a de-emphasizing of bone count from five demerits to two demerits per occurrence, and adding fat as a defect counting two demerits per occurrence of over quarter sized pieces except under the lateral line. Defects decreased as the season progressed.

#### **1985 LOT SUMMARY**

##### **Fillets**

<u>Seafreeze Lot No.</u>	<u>Grade</u>	<u>Gross Pounds</u>	<u>Case Count</u>	<u>Case Numbers</u>	<u>Daycode</u>
067136 10 (Orange)	C	825	6	1-6	20685
	C		5	7-11	20785
067137-10 (Brown)	B	1,200	4	13-16	22685B
	B		2	17-18	22685A
	B		4	19-22	22785A
	B		3	23-25	22785B
	B		3	26-28	22785C
067138 -10 (Blue)	A	1,125	1	31	23585A
	A		12	32-41	23585B
	A		3	42-44	23685A

##### **Finish Products**

299648 Raw Fillets, 18 lb cs	234	13
299649 O/R fillets, 20 lb cs	220	11
299667 Minced Pinks, 3 lb	1,113	16
299669 Fillet logs, 5 lb.	115	3

The one major problem never satisfactorily resolved was the occurrence of voids and crown in the blocks. Void occurrence appears to be directly related to thaw

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drip in short-term storage, indicating draining of the blocks as they waited to go into the freezer. With higher throughput and freezer cycling, less waiting should be required. Additionally, the blocks could be squeezed for a time before the refrigerant was turned on, allowing time for some of the air to escape.

Generally, the quality of the pack increased and the yield decreased as the season progressed. Problems with the fillet machine leaving rib bone tips in the belly flap led to J-cutting the fillets. Many crew members working on pin bone removal erred on the side of caution and yield suffered there as well. The skinner worked well but also seemed to take more fillet than was necessary to get the fat layer off.

The other quality progression was from layer iced fish to champagne iced fish in the later lots. The most obvious change was that chilled seawater fish, handled properly, were much firmer and had fewer bruises than layer iced fish. Live fish deliveries also worked well if the fish were brailled in small lined brailers. Pumping caused too many bruises in the live fish as they landed in the empty totes prior to weighing. Bleeding was not attempted, though this would probably have yielded fewer bruises. Unless this were done, there is no reason to use live fish as they must be held for 24-48 hours to come out of rigor.

# 1985 BACTERIOLOGICAL TESTS

## 1985 BACTERIOLOGICAL RESULT SUMMARY

Date/Lot No.	f/z		TPC	TPC	Total	Fecal(2)	Total
			35° F	25° F	Coliform	Coliform	Staph. aureus
					m		
<b>FILLETS</b>							
8/14	F	z		6,300	43	23	7
22685	F	z	1,000	4,000	9	3	23
	F(3)	z		13,000	23	3	1(1)
before dip	F	f		15,000	na	na	na
after dip	F	f		27,000	na	na	na
pack area	F	f		41,000	43	1	4
8/15 22785	F	z	250	1,300	3	3	3
	F	f		6,100	4	0	0
8/22 23585	F	z	1,000	12,000	14	3	15
	F	f		10,000	9	1	1
8/23 23685	F	z	320	1,200	9	9	7
<b>MINCE</b>							
7/25 20785	M	f	150,000	na	na	na	na
8/14 22685	M	f		3.9x10 <sup>6</sup>	43	2	4(1)
poor clean							
8/21 23485	M	z	9,200	6,300	93	15	21
8/22 23585	M	z	860	3,900	15	15	3
	M	f		28,000	31	1	1
8/23 23685	M	z	1,300	5,300	93	3	4

### NOTES:

- 1) Salmonella determinations - Positive test results by FITC using rapid identification strips. All tests by Bio Chem were negative.
- 2) Biochemical characterization of the FC isolates run by FITC showed none of the fillet samples contained Escherichia coli. Samples run on August 14 were characterized as Citrobacter freundii, Klebsella, and Enterobacter spp. Bio Chem identified Enterobacter cloacae, Hafnia alvei, and Streptococcus faecalis in samples from that date.
- 3) Channel water was used for make-up water during the unloading for this run -channel water is high in Escherichia coli, but not in coliforms isolated in August 14 samples.

The FITC ran plate counts on fish skin surface samples from two loads of fresh pink salmon on July 17, 1985. Other samples from frozen fish were run during

rancidity control experiments and test block production in Seattle prior to the 1985 season.

Skin samples	TPC per cm sq	
A	2,900	
B	2,200	
	<u>4 months</u>	<u>9 months</u>
Mince from frozen fish		
Fresh	80,000	75,000
Refrozen	60,000	14,000
Refrozen, Sodium Erythorbate (NaEr)	60,000	
Fillet, deep skinned by hand		145,000
Refrozen		29,000

Buyers' standards were used for guidance in the bacteriological standards. During the season, the only tests run on a routine basis were Total Plate Counts until the last week of production. With one notable exception, these showed uniformly low overall levels. However, when a more complete spectrum of tests was run, it became apparent that there were problems with pathogens, which were attributed to the use of channel water to pump out a live delivery. That practice had already been discontinued, and a more vigorous cleanup effort, particularly of the deboner, was undertaken.

After the season was over, tests were run on frozen samples which showed levels consistently over accepted standards for coliforms and staphylococcus. Based on analysis of the pathogens, Dr. Wetzler of Bio-Chem, the microbiologist, concluded that the source of contamination was probably human and/or animal contact, and that more thorough scrubbing of hands and use of a germicidal soap before handling the fish should be required. Iocide hand dips were used extensively during the processing, but he felt that scrubbing was necessary before these could be effective. There was extensive hand contact, owing to the difficulty of removing pin bones while wearing gloves.

For the next season, gloves should probably be required, as well as more thorough scrubbing of hands and raingear. Cutting the fillet into strips could be done wearing gloves. Some fillet operations have foot dips as well when entering or leaving the fillet area.

## 1986 PRODUCT EVALUATION

### Seafoods from Alaska Product

Several mince and salt addition rates were prepared to determine their effect on texture, binding and visual appeal. Logs of 4" diameter were used for these experimental runs.

Salt Levels	Mince Levels				
	0%	15%	30%	15% (washed)	100%
0.0%	X	X	X	X	X
0.5%	X	X	X		
1.0%	X	X	X	X	X

Prepared samples were steamed and an informal tasting was done with Roland Schwanke, Gary Ervin, Paul Peyton and Chuck Crapo. The 100% and 30% mince products were not as desirable as the 15% mince. Everyone preferred the 0% mince as the best product. The 15% mince seemed to be a good compromise, and everyone agreed that the mince did not affect the taste. The mince was not objectionable at that level. Both salt levels provided good binding of the mince products. They held together well after cooking. The consensus was that 1.0% salt made the product too salty while 0.5% had the right amount of salt. No salt provided a neutral taste and no binding.

The results of those tests follow:

% Mince	% Salt	Taste	Texture	Appearance
0	0.0	Mild, good	Flaky, moist	Crossed grain
0	1.0	Notice salt	Flaky, moist	Same, dark streaks
15	0.0	Mild, good	Slight coarse	Detectable mince
15	0.5	Detect salt	Slight tough	Detect mince
15	1.0	Notice salt	Tougher	Detect mince
30	0.0	Mild, good	Mince is mealy	Obvious mince
30	0.5	Mild, good	Mince is mealy	Obvious mince
30	1.0	Notice salt	Mince is mealy	Obvious mince
100	0.5	Mild, bland	Crumbly	Burgerlike
100	1.0	Notice salt	Tighter	Burgerlike

### North Pacific Processors Product

Standard defect tests were run during processing. Note that the thaw drip for most samples tends to be very high. The combination mince/fillet samples were mixed more and had salt added which reduced thaw drip considerably. The stuffed product was laid on freezer racks for blast freezing but ended up in the

aisle of the shelf freezer, which led to slow freezing and high drip loss compared to plate frozen products.

Several problems associated with the production set-up became obvious, but, due to space and time constraints, could not be addressed. These centered on lack of space for trimming and inspection, the lack of qualified inspectors and the lack of refrigerated holding space for stockpiled product.

#### NPP QC EXAMINATIONS

<u>8/20 Product</u>	<u>Thaw Drip</u>	<u>Defects</u>
1. Mince	10.75%	2 skin
2. Mince	12.74%	1 string
3. Fillet	6.58%	14 minor bones 2 major bones 1 skin
4. Fillet	4.90%	15 minor bones 1 major bone
5. Fillet	8.35%	22 minor bones
6. Fillet	8.89%	14 minor bones 1 major bone
7. Mince / Fillet	2.15%	16 minor bones 1 major bone
8. Mince / Fillet	3.50%	11 minor bones 1 major bone 1 skin
Average Mince	11.74%	Minimal
Average Fillet	7.18%	16 minor bones 1 major bone
Average Mince / Fillet	2.82%	14 minor bones 1 major bone

<u>8/24 Product</u>	<u>Thaw Drip</u>	<u>Defects</u>
1. Mince (Bibun)	9.72%	none
2. Mince (Beehive)	10.64%	none
3. Fillets	10.66%	4 minor bones 1 white skin 1 black skin
4. Fillets	9.16%	3 minor bones 1 bruise
5. Fresh Fillet	—	2 short ribs

## 6. Fresh Fillet

6 pinbones

1 pinbone

3 soft fillets

The largest unresolved problem is the high bacterial counts. According to preliminary work done at the FITC, nearly all the samples have APC's over 100,000 (for the 25° test). The high bacterial counts are probably due to slow movement of the product, repeated handling, and inadequate time/ temperature control. These problems could be addressed through revising the line layout and providing a chilled space to work in, but this was not feasible on a one day run. Test runs using standard 35° poured plate methods show much lower APC's, well within buyers' standards.

Total coliforms were generally in excess of the industry standard maximum of 100. High coliform counts probably indicate inadequate equipment sanitation and have been observed in many other operations using automated filleting and skinning equipment. Inadequate cleaning allows the hardier coliforms to become the dominant culture which contaminates later fish. The coliform species identified are not in themselves health risks but do indicate a problem. Fecals were generally quite low, indicating that the contamination is probably not of human origin. Unfortunately, the bacterial information was not available until after the run was completed due to the length of time required to transport the samples and conduct the tests.

It appears that addition of a caustic strip following foaming and high pressure washing is the necessary added step. TSP has been suggested as an agent that would do the job. A rinse with highly chlorinated water should follow.

86 PINK SALMON BACTERIOLOGICAL DATA  
NORTH PACIFIC PROCESSORS PRODUCTION

Sample	Size	TPC/g	Tot C/g <sup>(3)</sup>	Fec/g	Staph/g	Grade	Quant	Dispose
C23286	7.5	14,000	<u>460</u> 43	0.9 0.4	<0.3	B/C	553	AFDF
B23286 <sup>(2)</sup>	6.5	130,000 <sup>(1)</sup>	<u>460</u> 93	<u>23.0</u> <u>9.3</u>	<u>110.0</u>	A	1170	HOLD
			<u>460</u> 9.3	2.3 0.7	<0.3			
		1,400						
	7.5	130,000 <sup>(1)</sup>	<u>240</u> 24	2.1 <0.3	0.9 0.3	A	668	AFDF
			<u>460</u> 9.3	<0.3 <0.3	0.4 0.4			
		21,400						
		18,000						

F23286	6.5	61,000 <sup>(1)</sup>	<u>460</u>	0.9	<0.3	C	434	OCFD
		39,000	<u>1100</u>	<0.3	<0.3			
	7.5	48,000 <sup>(1)</sup>	23	0.9	0.4	C	1782	AFDF
		31,000	<u>460</u>	0.9	<0.3			
H23686 <sup>(2)</sup>	7.5	160,000 <sup>(1)</sup>	<u>640</u>	<u>23.0</u>	0.4	A	962	500 AFDF
		6,300	43	2.3	9.3			462 OCFD
			93	<0.3				
B23686	7.5	100,000 <sup>(1)</sup>	<u>460</u>	<u>4.3</u>	2.3	A	3339	1339 AFDF
		7,600	<u>150</u>	<0.3	<0.3			2000 OCFD
		8,300	93	0.4	<0.3			
		12,100	23	<0.4	<0.3			
F23686	6.5	41,000 <sup>(1)</sup>	<u>1100</u>	2.3	9.3	A/B	1457	OCFD
		11,000	<u>460</u>	<0.3	0.4			
			43	<0.3				
		19,000	93	0.4	0.7			
		10,000	75	<0.3	0.4			
		15,000	93	0.4	<0.3			
	7.5	130,000 <sup>(1)</sup>	<u>1100</u>	0.9	0.9	B	2624*	1000 AFDF
		21,000	<u>110</u>	<0.3	<0.3			1624 OCFD
		22,000	<u>430</u>	0.4	<u>24</u>			
		8,500	43	0.4	0.9			
		16,000	93	<0.3	0.9			
SFA15%	6.5	3,900	4.3	0.3	4.3	A	269	OCFD
SFAfil	7.5	17,000	4.3	0.7	4.3	B	630	OCFD
SFAfil	6.5						294	OCFD
M23686	6.5						93	
	7.5						158	

NOTE: Underlined values exceed buyers' standards or ICMSF marginal limits.

(1) Tests run by FITC using 25 deg. test which gives higher numbers than standard 35 deg. poured plate test.

(2) Fails to meet standards of contract and may not be useable.

(3) Contract specifications call for less than 100 C/g, as is stated in various buyers specifications. As nearly all samples exceed this level, but show very low fecal coliform, TOC's and staph levels, this requirement will be waived if the contractor issues a letter explaining the reason the level is so high and corrective measures that would eliminate the problem in commercial production.

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#### IV. FUNCTIONAL ANALYSIS AND RANCIDITY CONTROL

## **FUNCTIONALITY AND RANCIDITY CONTROL**

Rancidity tests were run by the principal investigator and staff at the NMFS Utilization Lab in Seattle. Following those test results are an evaluation of block products conducted by the FITC staff.

### **DCED and NMFS Tests**

Thio Barbituric Acid (TBA) tests were used to evaluate development of rancidity. It should be noted, however, that TBA values are only useful when their progression is tracked through time. TBA values tend to increase to a maximum and then decrease as rancidity develops. Based on the TBA tests and organoleptic testing, simple vacuum packaging would be adequate to protect low fat mince from rancidity. The antioxidants do not add much to the effectiveness of the barrier film.

Whether treated, poly bagged product would hold up for more than six months is unknown. The Sodium Erythorbate / Ascorbate treated block was carefully wrapped in heavy poly and was still acceptable after 13 months. The other blocks tested were put up during the production run without using ascorbate in the dip, and were not poly wrapped in cold storage. They developed more rancidity in seven months than the other one had in 13.

Taste tests run on formed samples from blocks stored normally in commercial cold storage showed very good quality after seven months. Occasional occurrences of slightly fishy taste are likely due to the fatty tissues left under the lateral line. These may indicate incipient rancidity. Further tests are planned using formed product, both breaded and unbreaded, that has been vacuum packed as finished product.

### **TBA Tests**

Milligrams of Malonaldehyde per 100 Grams of Tissue

<b>Mince from 5 month old frozen fish:</b>	<u>0 months</u>	<u>3 months</u>	<u>7 months</u>	<u>13 months</u>
Poly bagged	0.16	0.61	0.66	0.076
Vacuum packed (VP)	0.18	0.26	0.36	0.43
NaEr/Ascorbate (Asc.) (VP)	0.10	0.00	0.20	0.32
Block, not VP				0.36
TBHQ + VP	0.13	0.00	0.27	0.36
Fillet Blocks, 85 Product				
Lot 67138			0.47	
Lot 23685			0.33	
From frozen fish smelled rancid			<u>9 months</u>	
Fillet			0.083	
Mince			0.093	

Taste tests were run using boiling bags with ten minute cook times. The setting was very informal, with discussion of corresponding samples by the two members as the test progressed. This is obviously a very subjective evaluation. A more structured and larger test is needed for next year. Using boiling bags is a very sensitive method, of course, and does not necessarily reflect the end consumers' reaction to a seasoned product.

The sensory data correlates roughly with the TBA data, but is not particularly reliable due to the small size and changing composition of the panel. One member was present at all tastings, and the other member changed between seven and 13 month tastings.

Note that the TBHQ (a type of food grade antioxidant) data is fatally flawed from the beginning, in that excessive propylene glycol was used to dissolve the TBHQ crystals, tainting the samples.

Note also that there was a distinct taste associated with the sodium erythorbate/ascorbate samples as well, though this was much less noticeable and would have been easily masked by seasonings.

#### 1985 RANCIDITY CONTROL SENSORY EVALUATIONS

	<u>0 Months</u>	<u>4 Months</u>	<u>7 Months</u>	<u>13 Months</u>
Control	Good odor and taste, very slight bitter	Good odor and taste, slight bitter	Medium rancid old fish odor fair taste, could be covered	Fair odor and flavor, bitter rancid after-taste
Vacuum	Good odor and taste, very slight bitter	Good odor and taste, no rancid	Slight rancid or bitterness, good odor	Good to rancid flavor (differ in samples?)
Sodium Erythorbate (NaER)	Distinct chemical taste and odor	Distinct sharp odor, fair-good taste	Fair, chemical odor, no chemical taste, good flavor	Fair odor, good flavor, tough
TBHQ	Obvious, objectionable glycol odor, covers taste	Difficult to evaluate, glycol odor	Difficult to evaluate, obvious odor	Distinct alcohol odor, taste
NaEr Block				Fair odor and flavor, chemical taste, some to strong rancid
67138 Block			Fair odor and taste a little tough, none to slight rancid	
23685A			Good odor, fair flavor slight rancid (sample from edge of block rated worse)	

## Functionality

Thaw drip tests were the only functional tests run on any samples. No obvious correlations exist, though initially the antioxidants seem to bind up water in the mince. Also, there appears to be a maximum in the thaw drip values for the mince between seven and 13 months, followed by a decline.

The fillet blocks tested seem to have higher drip loss initially, with no decline evident in the production blocks at seven months. All values are under the 7% ceiling for pollock listed on the buyers' specification sheet.

### THAW DRIP TESTS

Mince from 5 month old fish:

	<u>0</u> <u>months</u>	<u>3</u> <u>months</u>	<u>7</u> <u>months</u>	<u>13</u> <u>months</u>
1. Poly bagged	2.6	4.6	4.3	4.9
2. Vacuum packed (VP)	2.6	4.2	5.9	4.4
3. NaEr/Asc. (VP)	1.7	2.5	4.8	4.1
Block, no VP				5.5
4. TBHQ (VP)	0.9	3.6	5.2	2.6
5. Frame (bloody)	7.6			
6. Fillet blocks (85 product)				
67138(A)	4.6(ave)		4.6	
23685	4.6(ave)		4.6	
7. Fillet blocks from frozen (twice frozen)				
Shallow skinned	3.6			
Deep skinned	4.8			
With mince 16%	3.4			

## Moisture Contents

02/25	Mince from frozen fish for TBA tests:	Solids	
		23.7%	
		24.6%	
05/30	From 9 month old frozen fish produced at Seafreeze:		
	Fillet	27.8%	25.4%
	Mince	19.2%	18.6%

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## Oil Content

Shallow skinned fillets		9.0%
Deep skinned fillets		0.7%
Deep skinned fillets with 16% mince		1.6%
Mince from frozen fish:	Control	1.0%
	Vacuum Packed	0.4%
Estimated oil content on deep skinned pink salmon fillets and mince ranges		0.5-1.5%

## Proximate Analysis

From four month old frozen (September 1984 fish):		
Fat		1.0%
Protein		20.21%
Ash		1.2%
Iron	Fillets	4.6 ppm
	Mince	6.7 ppm

## Kodiak FITC and NMFS Experiments - by Chuck Crapo, Elisa Elliot, FITC; Jerry Babbitt, NMFS; and Paul Peyton, DCED

Fresh-Frozen Product/Shelf Life Evaluations. Fresh pink salmon were dressed, hand or machine filleted and skinned, then trimmed to produce boneless fillets. Trimmings, which included pin and rib bone fractions (Figure 1), were minced using a Baader 694 deboner. Using 18.5 pound metal forms, pink salmon blocks of 100% fillet, 100% mince, 75% fillet/25% mince, and 50% fillet/50% mince were produced, frozen and stored at -18°C (0°F) for 1, 3, 6, and 12 months. Fillet (100%) blocks were used as controls and stored at -36°C (-34°F).

At the end of each storage period, product forms were evaluated for sensory, oxidative and physical changes. Sensory evaluation scored color, flavor, chewiness, moistness and desirability on a seven point descriptive scale and texture on a five point scale. Color and moisture descriptors were anchored to the control samples. Taste panel data was analyzed using a factorial design and least squares difference to determine the effect of storage and product form on shelf life. Fat oxidation was determined using Lemon's modified TBA test (1975) and thaw drip (AOAC, 1984) was used as a measure for some of the physical and sensory changes occurring during frozen storage. Microbial counts were made on the fresh mince and fillets as an indication of product handling and after 6 month frozen product to determine the extent of bacterial die-off in storage.

Reprocessed Product/Shelf Life Evaluation. Frozen, dressed pink salmon stored at -18°C (0°F) for 3, 6, and 12 months were thawed overnight at 10°C (50°F), hand filleted, skinned and trimmed to produce boneless fillets. The trimmings were minced using a Baader 694 deboner. Fillet, mince and combination fillet/mince

blocks were produced, refrozen and stored at -18°C (0°F) for 0, 3, 6, and 9 months. At the end of each storage period, the reprocessed blocks were compared with the fresh/frozen samples and evaluated for sensory, oxidative, and physical changes.

**Packaging/Antioxidant Evaluation** Pink salmon blocks of 75% fillet/25% mince were prepared using deep and shallow skinned, boneless fillets, treated with sodium erythrobate (0%, 0.25%, 0.50% and 1.0%) or 0.45% ascorbic acid/0.05% citric acid and frozen. Blocks were packaged in four mil vacuum bags or two mil plastic bags and cardboard cartons and stored at -18°C (0°F) for 1, 7, and 14 months. At the end of each storage period, samples were evaluated for sensory, oxidative and physical changes.

## Results and Discussion

**Recoveries.** Fillet and mince yields from round fish varied with filleting methods (Table 1). The use of mechanical filleting equipment resulted in slightly higher recoveries than hand filleting. Its addition to the combination fillet/mince blocks maximized recovery and provided 40% more product.

**Table 1. Recovery of Fillets (Skinless, Boneless) and Trimmings From Manual and Mechanized Operations**

% RECOVERY (WHOLE WEIGHT BASIS)	Manual (Deep-skinned)	Mechanical (Deep-skinned)
Fillets skinless, boneless	33.26%	33.56%
Trimmings	12.24	14.76

**Fresh Frozen/Reprocessed/Shelf Life Evaluations.** After one month storage, the fresh/frozen products compared favorably with the control samples. Taste panelists preferred the 100% fillet and 75% fillet/25% mince blocks over those with higher mince ratios. Fat oxidation was minimal as evidenced by the low TBA values (Table 2). Thaw drips averaged 2-3%.

**Table 2. TBA Values (mmoles/100g) For One Month Fresh/Frozen Pink Salmon Blocks**

TREATMENT		FORM (% FILLET)			
		100%	75%	50%	0%
Fresh/Frozen Block	0.83	0.82	0.80	0.84	
Control	0.80				

At three months storage, fresh/frozen and reprocessed blocks were compared. The reprocessed blocks had lower sensory scores, TBA values and higher thaw drip than the fresh/frozen product. Taste panelists preferred the fresh/frozen products because they had better flavor and moistness than the reprocessed blocks. The 100% mince block scored significantly lower than other product

forms. Taste panel scores revealed that the mealy texture of the mince block lowered overall desirability. TBA values of the fresh/frozen blocks were much higher than reprocessed product (Table 3).

**Table 3 TBA Values (mmoles/100g) for Three Month Fresh Frozen and Reprocessed Pink Salmon Blocks**

TREATMENT	FORM (% FILLET)			
	100%	75%	50%	0%
Fresh/Frozen Block	1.61	1.31	1.50	1.48
Reprocessed Block	0.71	0.78*	0.85*	0.98
Control	0.80			

\*Estimated Values

It appeared that processed products were more susceptible to the development of rancidity during frozen storage, due in part to the protection of the product in frozen storage. The fresh/frozen products were stored in waxed liners and plastic lined master cartons while the dressed salmon had been glazed and double plastic wrapped. Thaw drips were highest for the reprocessed products as a result of double freezing (Table 4). Most were within reasonable limits although the reprocessed 100% mince block had a thaw drip of 5.39%, considered unacceptable by many Alaska seafood processors.

**Table 4. Thaw Drip Values for Three Month Fresh Frozen and Reprocessed Pink Salmon Blocks**

TREATMENT	FORM (% FILLET)			
	100%	75%	50%	0%
Fresh/Frozen Block	2.96%	4.46%	2.65%	3.06%
Reprocessed Block	4.38%	3.60%	3.64%	5.39%
Control	2.15%			

After six months of frozen storage, differences between fresh/frozen and reprocessed products were small. Fresh/frozen products were generally better than the three and six month reprocessed products. The exception was the 100% mince block which had the lowest desirability scores of any sample. The high fillet products continued to be more desirable than the high mince products. Average sensory scores indicated the test panel preferred the 75% fillet/25% mince and 100% fillet forms. These samples had better flavor, texture and moistness. The first rancid and oxidized flavors were noted in some of the samples. TBA values were highest for the three month reprocessed product that had been stored an additional three months and lowest for the six month reprocessed product (Table 5).

**Table 5. TBA Values (mmoles/100g) for Six Month Fresh Frozen and Reprocessed Pink Salmon Blocks**

TREATMENT	FORM (% FILLET)			
	100%	75%	50%	0%
Fresh/Frozen Block	1.33	1.32	1.12	1.38
3 Month Reprocessed Block	1.68	1.54	1.44	1.75
6 Month Reprocessed Block	1.26	1.02	1.21	0.87
Control	0.80			

This indicated that thawing, refreezing and subsequent storage accelerated the development of rancidity in the products. TBA values for the fresh / frozen products remained fairly constant. Thaw drips were highest for the reprocessed products revealing the effect of thawing and refreezing (Table 6). All reprocessed samples had excessive thaw drips of 5.6% or greater indicating changes in the texture and moistness that were confirmed by the taste panel. The fresh / frozen products had acceptable thaw drips less than 4.5%.

**Table 6. Thaw Drip Values for Six Month Fresh Frozen and Reprocessed Pink Salmon Blocks**

TREATMENT	FORM (% FILLET)			
	100%	75%	50%	0%
Fresh/Frozen Block	2.70%	3.55%	3.56%	4.45%
3 Month Reprocessed Block	8.04%	5.58%	5.77%	7.34%
6 Month Reprocessed Block	5.60%	5.77%	6.31%	6.29%
Control	2.06%			

At the end of twelve months frozen storage, sensory scores were significantly lower revealing the general deterioration of all products. No noticeable differences existed between the fresh / frozen and reprocessed forms although the fresh / frozen and twelve month reprocessed products had the slightly higher desirability than other samples. The three month reprocessed samples, the longest stored in frozen storage, had the lowest scores. Taste panelists again preferred the 100 % fillet block form over all others and expressed a significant dislike of the 100 % mince blocks. Thaw drips were high for all products ranging from 3.43 % for the fresh / frozen fillet to 11.80 % for the twelve month

reprocessed 50 % fillet block (Table 7). Most samples had excessive drip although they were the lowest for the fresh/frozen product. All reprocessed products had drips exceeding 6.91 % which contributed to the poor texture scores. Most of these products would have been unacceptable for commercial packs.

**Table 7. Thaw Drip Values for Twelve Month Fresh Frozen and Reprocessed Pink Salmon Blocks**

TREATMENT	FORM (% FILLET)			
	100%	75%	50%	0%
Fresh/Frozen Block	3.43%	5.85%	5.26%	4.61%
3 Month Reprocessed Block	9.40%	9.49%	6.91%	8.28%
6 Month Reprocessed Block	11.74%	8.29%	9.46%	10.90%
12 Month Reprocessed Block	7.78%	10.21%	11.80%	11.07%
Control	3.43%			5.33%

Microbial condition of the reprocessed blocks was good (Table 8). Low aerobic plate counts and fecal coliforms of the fillets were indicative of good handling. Increased counts found in mince suggested that there may have been poor handling conditions for this product. It also points to the susceptibility of fish mince to bacterial contamination. During frozen storage periods, die off of the initial bacterial populations was very evident. At six months frozen storage, the microbial levels were very low.

Packaging / Antioxidant Evaluations. The use of ascorbic/citric acid as an antioxidant adversely affected product flavor, moistness, chewiness and desirability. Its use produced an acid bite that was unacceptable. After one month of frozen storage, no sensory differences were found between erythrobrate treated and untreated samples although the erythrobrate samples scored slightly higher in flavor and desirability. No significant differences were noted between packaging materials although the vacuum packaged product had slightly higher sensory scores and no differences existed between shallow skinned and deep skinned products although the shallow skinned forms were rated higher in flavor and desirability.

After seven months storage, vacuum packaged product had better flavor and desirability than plastic wrapped product. This difference can be attributed to slower fat oxidation in the vacuum package. Deep skinned product was more desirable than shallow skinned product. This can be attributed to the partially oxidized fat layer present in the shallow skinned samples. No differences existed between erythrobrate treated and untreated samples as all samples scored equally in color, texture, flavor and desirability. No differences existed between the levels

of sodium erythorbate. The panelists were unable to detect any differences among the samples which suggested that the levels of sodium erythorbate did not change the flavor or desirability of the products.

**Table 8. Microbial Loads of Pink Salmon Forms at 0, 3, and 6 Months**

Form	Aerobic Plate Count/g (APC)	Total Coliforms/g (TC)	Fecal Coliforms/g (FC)	<u>Staphylococcus aureus</u> (presence/absence)
Fresh Product				
Fillet	350,000	240	0.4	-
Mince	960,000	93	0.7	+
Fillet/Mince	1,700,000	240	150	+
3 Month Frozen Storage				
Fillet	2,700	0.4	<0.3	-
Fillet	7,200	0.4	<0.3	+
Mince	110,000	1.5	<0.3	-
Mince	210,000	1.5	<0.3	-
6 Month Frozen Storage				
Fillet	3,400	43	<0.3	-
Fillet	4,500	23	0.4	+
Mince	3,900	1.5	0.4	+

At fourteen months storage, all product forms were marginally acceptable. No differences were found between levels of antioxidant or packaging method. The only preferences noted was for deep skinned products. The deep skinned products had better flavor, moistness and desirability indicating that the removal of the fat line was a positive factor in maintaining quality.

TBA values used as a measure for rancidity revealed that products treated with sodium erythorbate had lower initial values than either the untreated and control samples. Vacuum packaged products had lower values than plastic wrapped samples. Deep skinned product had less oxidation than the shallow skinned product. It appears that skinning, antioxidant and packaging are all effective in reducing oxidation and that combinations have an additive effect. All levels of erythorbate were effective in slowing oxidation in both product forms. This effect was more pronounced with the shallow skinned product where the fat layer remained intact. All TBA values were low (below 2) indicating that the products were of acceptable quality.

Thaw drip was in normal ranges although the deep skinned product had higher values than shallow skinned product. This is probably due to variation between the groups of fish rather than the skinning method. The addition of sodium erythorbate did not affect the thaw drip. Thaw drip showed the typical variation between samples that have been experienced in this project. All thaw drip are within expected ranges. The addition of sodium erythorbate did not affect the thaw drip among the samples while the ascorbic/citric acid mix reduced the pH and water binding capacity of the product resulting in much higher thaw drips.

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## CONCLUSIONS

*This project produced alternate pink salmon products that had acceptable shelf life and provided alternatives to processors needing to diversify. The major results from the study include:*

- 1. Combination fillet/mince products provided the optimum mix of recovery and acceptability. Returning mince to the product increased yields by 12 to 14 % on a whole weight basis.*
- 2. Fresh/frozen product was slightly more desirable than the reprocessed forms although pink salmon stored for three months produced very acceptable blocks. After six months storage, all products were indistinguishable.*
- 3. The most desirable product form was the 100 % fillet block. The least desirable form was the 100 % mince block. No more than 25 % mince could be added back to the product and maintain acceptable sensory properties.*
- 4. Thaw drip increased substantially in the reprocessed products and adversely affected texture and desirability. Thaw drip increased in frozen storage and became unacceptable in the reprocessed products at six months and in the fresh/frozen products at twelve months.*
- 5. Frozen storage time for both fresh/frozen and reprocessed products should be limited to six months. At twelve months frozen storage, all products had deteriorated significantly. This was especially noticeable in the high mince products.*
- 6. The use of ascorbic/citric acid as a potential antioxidant is not recommended.*
- 7. Packaging method, antioxidant treatment and skinning depth all contributed to better product quality during frozen storage. Frozen storage time for these products should be limited to seven months. At fourteen months, all products were unacceptable.*

## ACKNOWLEDGMENTS

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## V. FOODSERVICE MARKET TESTING

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## **Foodservice Market Testing**

by Eric Eckholm, Healthsea

### **Summary**

The products developed during this project for use in market testing were made from boneless, skinless fillet and minced logs. One product was cut as a "steak" portion from the fillet log and the other was cut as "paddy" from the minced log. Both were proportioned for exact weight.

The market testing included a sampling/questionnaire effort at a foodservice trade show resulting in 150 finished surveys, five direct market tests in Minneapolis, Portland, Austin, Lake Tahoe and San Diego and a focus group of foodservice professionals in Seattle.

The results clearly show a market for the product, within specific markets and at a moderate price point. The product was well received, and especially perceived as an appropriate product for outlets which do not specialize in seafood as a seafood entree.

The fillet product was far preferred to the minced product for texture, taste and moisture. The ability to achieve exact portion control, the lack of skin and bones and the good flavor were strong positives. The re-formed look which was not "fishy," the dryness of the minced product and the estimated price presented areas of concern.

Based upon assumptions developed through this project, there is a possible new-product market which could utilize approximately 15 million pounds of Alaska's annual pink salmon harvest, selling for a wholesale price of approximately \$2.45/lb. for the fillet steaks and \$1.42/lb. for the minced salmon.

The U.S. foodservice market consumes approximately two-thirds of the seafood used in America. Households spend an average of \$30/week on food away from home. The foodservice industry offers a good test opportunity because it is relatively easy to target potential segments of the market, and food professionals are responsible for testing and preparing the product, allowing for greater control over preparation and the ability to test without the added expense of consumer packaging.

### **Market Tests**

The U.S. foodservice market was analyzed to determine which particular segments of the industry were most appropriate for the product forms developed. It was determined through interviews and existing data that the most appropriate targets were family style restaurants and institutional feeders.

A list of two hundred possible outlets was developed, and recipes were created for these markets. A direct mail piece detailing the product was sent to the selected outlets soliciting their interest in sampling and test marketing. In addition, the contractor participated in a foodservice tradeshow to further target the market segments and solicit interest in test marketing. Twenty-one 10 pound

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sample boxes were distributed to interested parties, and five actual test markets were conducted.

The test markets were selected based upon interest, geographical distribution, market segment represented and willingness to cooperate with the project. Silver Lining Seafoods assisted with test market development and distribution. Test markets included a small chain of delicatessen / family style restaurants in Minneapolis, Minnesota, a nursing home in Portland, Oregon, a small chain of truck stop style restaurants in San Diego County, a seafood chain in Austin, Texas and a hotel / casino in Lake Tahoe, Nevada.

In addition to the market testing, a focus group (a structured group interview of foodservice professionals) was conducted in Seattle, Washington to further explore reaction to the products tested.

Overall, the product was very well received in the market tests. Results ranged from enthusiastic to good. Based upon the market testing there is a good indication that the product would be acceptable (given certain price, quality and geographic considerations) to specific segments of the U.S. foodservice marketplace.

#### *San Francisco Trade Show*

Both the fillet steaks and minced salmon were tested at a seafood trade show on December 8 & 9, 1986 at the Foodservice Trade Center in San Francisco.

Approximately 1,500 foodservice professionals attended the show. Samples of the product were distributed from the booth, and 153 questionnaires were completed by direct interview after sampling.

The product was prepared by the nutritionist under contract to the project and was presented grilled and breaded / battered and deep fried, with both fillet steaks and minced salmon.

The results were very positive. Most people interviewed liked the product. The major problem apparent from the interviews was the perceived dryness of the minced product. The shape of the product was also questioned, "It doesn't look like fish..." being a common response.

Pricing estimates were difficult to obtain, and were always qualified as complete guesses. Most people were reluctant to guess prices and wanted to have costs provided to them. Price estimates on the following table are based upon the cost for a 6 oz. portion. The results are not accurate enough to provide any pricing guidelines, but the guesses given indicated a price acceptance of \$1.20--\$1.80/lb. for the minced product and \$2.50 -- \$4.00 for the fillet product. A summary of the results of the questionnaire follows.

#### *Minneapolis Test*

A market test was conducted in Minneapolis, Minnesota with operators of a twelve unit family style / delicatessen restaurant chain. The results were very positive.

Six-ounce fillet-steaks were served at both lunch and dinner in several of their outlets. A number of serving methods were used, including poaching, broiling,

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baking and deep frying. The product was also allowed to thaw, cooked in pieces, chilled and served as a salmon salad. All preparations were well received. The products sold for \$5.25/plate for lunch and \$7.95/plate for dinner.

The wholesale value of the fillet steaks based upon this portion price is approximately \$2.25.

Customers were extremely pleased with the product, and employees indicated the product was easy to work with, and, "If the customers are happy, we're happy."

#### *Portland ,OR Test*

A test was conducted at the Crestview Convalescent Home in Portland, Oregon. This is a private nursing home for older people who require a lot of care. Martha Hepting, the dietary supervisor, conducted the test with the fillet steaks.

The product was lightly coated with a flour mixture and baked for 15 minutes in a 350 degree oven, then served with a sauce. The results were very good. The patients liked the product a lot, and the staff liked the product as well. The major complaint was the difficulty of separating the steaks which had bonded together after portioning. This was a source of extreme frustration to the kitchen staff and would result in an unacceptable product if not corrected through modified packaging.

The primary considerations for ordering a product are price, convenience of preparation, and size of portions. Nursing homes require smaller portions (3 - 4 oz.) for their patients. They also prefer non-breaded and battered products. Crestview is considered a higher end facility and expends additional time and expense on foodservice compared to the average nursing home, according to Mrs. Hepting. They serve seafood often, including red snapper, fresh salmon, canned salmon and they prefer fresh to frozen products. Mrs. Hepting estimated \$2.50/lb. as the cost which they would be willing to pay for the product.

The product benefits were primarily the ease of preparation, the taste, the lack of skin and bones and the soft texture. Mrs. Hepting did not test the minced product, but indicated she would prefer to buy minced in a bulk pack rather than portioned if that would result in a lower price. She most likely would use the product as an ingredient for salmon loaf.

If Crestview included the fillet steaks as a regular item, they would serve it approximately twice monthly, which would result in orders of approximately 25 lbs/ month for the product.

#### *San Diego Test*

A market test of the fillet steaks was conducted with Aunt Emma's Restaurants, a small chain of family style coffee shops in El Cajon, California, a suburb of San Diego. These restaurants are typical of a large number of restaurants in America, small independents, located near freeway exits and traveler's motels, serving a general menu of American food with very little seafood.

They served the product breaded and battered and deep fried. The retail price was \$4.75 for the plate. The fillets were 4 oz servings. Using standard prices and

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mark-ups, this nets back to a value of \$3.37/lb. wholesale, delivered to San Diego (\$4.50/lb. to restaurant, 25% mark-up by distributor).

Currently they serve cod for fish and chips. Cod prices have been rising, and they see the pink salmon as a reasonably similar product to cod.

The operators like the product, would consider it as a regular special in the restaurants, and estimate a monthly volume of 40-50 lbs/restaurant if served regularly.

#### *Austin, TX Test*

Southpoint Seafoods, a specialty seafood restaurant chain participated in the market test in Texas. They served the minced salmon as a sandwich and the fillet steaks in several methods; blackened (cajun-style), fried, baked, and broiled. The herb-butter recipe developed for the project was served with the product.

They liked the product very much. They are primarily a fresh only seafood chain, but found very good customer acceptance. Their estimated price to them for the product was \$1.25/lb. for minced and \$2.00/lb for fillet. They preferred four ounce portions for minced and 6 oz. for fillet steaks.

The fillet steaks were by far the preferred product. The minced salmon was used only for sandwiches. Concerns about the product were the need for interleaving to improve separation of portions, reshaping the minced salmon for sandwich use (it looked too much like Spam to them) and concern about the dryness of the minced product. They would not add to their menu, but predicted the product would be very acceptable to most family style restaurants and should achieve up to 10% of menu selection for a typical small restaurant.

#### *Lake Tahoe, CA Test*

A market test was conducted for the fillet steaks at Harvey's Resort Hotel in Lake Tahoe, Nevada. The product was served in the coffee shop both grilled and battered and fried. It went over, "...very very well."

The product was served as a full dinner. Two 4 oz portions were served, sautéed after being dipped in flour and egg, and served with caper butter.

The reaction was good. The test product replaced natural fillets which were being served in the same manner. The price for natural fillets to Harvey's is \$2.30/lb. Harvey's estimated value for the product is \$2.00/lb.

#### *FOCUS GROUP*

An additional market research tool, a focus group, was added to the market test to obtain additional evaluations of the fillet steaks and the minced product from foodservice professionals. Nine foodservice operators, both commercial and non-commercial, participated in the focus group, which was directed by the consulting nutritionist for the project.

The results were moderate. A significant consideration regarding the product was the comparison to natural salmon fillets. The focus group test was conducted in Seattle, and all the participants were familiar with salmon. Their expectations of the product were, therefore, compared to their existing

perceptions of their experience with salmon, and they concluded that the product was inferior to traditional salmon.

The major suggestions to improve to the product are to increase the moisture of the minced product, remove more of the brown back strip to improve appearance and to shape the product more like a natural fillet or steak. Price estimates were \$2.67 to the operator for the fillet product and \$2.10 for the minced for commercial operators and an average estimated price of \$2.29/lb. for the fillet steaks and 1.00/lb for the minced product from the non-commercial operators. A full report on the test follows.

#### **Summary of Results/Projections**

The results of the market test indicate that the fillet steaks would be accepted as a viable foodservice product in selected segments of the industry with minor modifications.

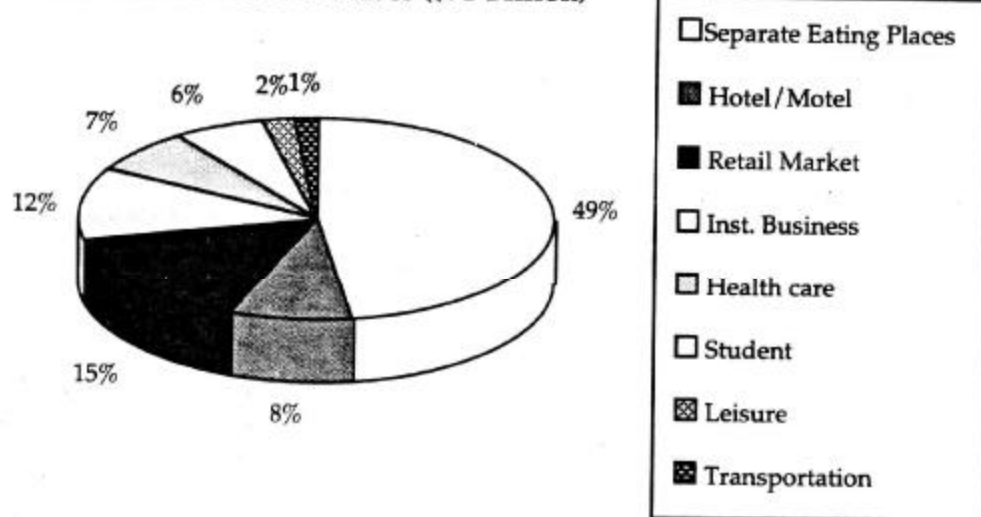
#### **Value Perceptions of Pink Salmon Products**

<u>Market</u>	<u>Minced</u>	<u>Fillet</u>
Foodservice Show (avg.)	\$1.33	\$2.52
Minneapolis		\$2.25
Portland		\$2.50
San Diego		\$3.37
Austin	\$1.25	\$2.00
Lake Tahoe		\$2.00
Focus Group		
Commercial	\$2.10	\$2.67
Non-Commercial	\$1.00	\$2.29
<b>Avg. Estimated Wholesale</b>	<b>\$1.42</b>	<b>\$2.45</b>

These estimates are very broad, and based upon a wide variance of price estimating. They only represent a value perception, which indicates that the reformed product should be valued somewhat under the market price for salmon fillets. Species of salmon fillets was for the most part not critical to foodservice operators when questioned. The current wholesale price (4/87) for 4 oz steaks, unspecified species, is @2.38 and 6 oz. fillets \$2.97, FOB Seattle (source: foodservice purchasing group).

The market targets for the product were confirmed by the testing and indicate good acceptance by family style restaurants (coffee shops, delicatessens, mid-price restaurants) and segments of the institutional market, including health care facilities.

**1985 Foodservice Purchases (\$71 Billion)**



*Projections:*

The U.S. foodservice industry is a \$175 billion dollar industry, with food purchases of \$71 billion annually (as of 1985).

The market research with the pink salmon products indicated that they would be acceptable to family-style restaurants and institutional segments of the industry. These segments represent about 25% of the total industry, or a total food purchase volume of approximately \$18 billion annually.

Center of the plate purchases are approximately 67% of the total sales, therefore the total competing market within the targeted segment is approximately \$12 billion.

Acceptance of the product within the targeted segment is limited somewhat due to geographical bias (N.W. region strongly prefers traditional salmon --other areas tested did not indicate the same level of concern) and financial capability (institutional markets such as schools, prisons, and health care facilities regulated through federal programs tend to be extremely cost conscious in their food purchasing, therefore their ability to purchase more expensive protein is limited).

Assuming seafood represents about 6% of the market, seafood sales to the target market are approximately \$.75 billion. If pink salmon were to achieve 1% of the seafood market, then approximately 7.5 million pounds of finished product could be marketed to the U.S. foodservice industry. This represents about 15 million pounds of whole pink salmon, or about 6% of the average annual production of pink salmon in Alaska.

Of course, these estimates are very broad. The primary result of the study is proof of the acceptance of the product at foodservice by a wide variety of

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restaurant types in varied regions of the country. True results of the product would have to be based upon a full marketing effort introducing the products to the trade with a commitment of resources, sales and marketing.

### **Recommendations/Conclusions**

The fillet steaks should be reshaped and packaged to allow easy separation of portions. Taste and quality perceptions were very good, and if produced and priced competitively the fillet steaks could be marketed successfully.

The minced product must retain more moisture and may only be acceptable as an ingredient for further processing unless modified. Further market research on appropriate packaging, product modifications and additional product testing should be undertaken prior to reaching any final conclusions regarding the minced product.

Production considerations to allow production of fillet steaks and minced salmon at the minimum possible price are extremely important to market acceptance.

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## VI. INDUSTRY REVIEW

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## **Advisory Committees**

Two advisory committees were formed, the Production and Marketing, and Scientific and Quality committees. These committees met twice during the project. Summaries of the input received and the advisory committee membership follow.

### **Advisory Committee Summary (sent out 7/2/86)**

The Scientific and Quality Advisory Committee met June 11, 1986 in Anchorage. Attending were all committee members and Bill Wasson of Bering Sea Fishermen's Association.

As expected, many people are interested in working on various aspects of the pink salmon problem. Topics to be addressed and people probably covering them are as follows:

1. Literature search - Don Kramer and Chuck Crapo to survey the existing literature for information specific to salmon or other oily Pacific coast species on rancidity control, packaging, and functional characteristic changes in freezing and storage with explanatory notes. An ASH disk would be available with this file for a nominal fee.
2. Functional characteristics and rancidity control - evaluation of sexual maturity, handling, and packaging on rancidity development and functional characteristics (as measured by thaw drip).
  - Chuck Crapo (with AFDF involvement)
3. Formulation and color - Peyton will evaluate additives such as serum, mince, washed mince, and carboxymethyl cellulose for texture modification, binding characteristics, flaking, shelf life.
4. Microbiological work - Elisa Elliot and Jong Lee to evaluate micro loads on incoming fish, at various processing steps, in final products and will isolate sources of any pathogens.

The production and marketing committee met in Seattle. Members attending are noted on the membership list. Additional interested observers were Linda McGowan of Deep Sea Fisheries, and Sharon Gwinn of First Surimi, Inc., and, formerly, of AFDF.

Discussion centered on the relative cost of producing non-IQF frozen boneless skinless products for reforming as opposed to the likely sale price. Bill Woods provided the following comparison table to evaluate pink salmon fillets and blocks in comparison to other competing products.

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	<u>IQF. b/s</u>	<u>Block</u>	<u>Mince</u>
Cod	\$1.60	\$1.35	\$0.65
Pollock	1.10	0.75	0.40
Halibut	3.70	4.25	
<u>Salmon</u>	<u>H&amp;G</u>	<u>Fillet</u>	<u>Steak</u>
red	2.40	4.00	3.50
chum	1.20	3.10	2.20
pink	0.90	2.00	0.80 (mince)
		1.80-2.25	
		skin on, bone in	

Several observations were made:

- Reformed boneless, skinless products are covered, detracting from the selling ability of salmon's visual appeal.
- With existing technology, it is very difficult to produce an attractive natural fillet with the pin bones removed, so is this actually an alternative?
- Pin-bone-in product is limited in market and is not attractive to the national food companies and institutional and food service operators for whom the reformed product is an option.

In conclusion, the opinion of the marketing segment was that bulk pack, boneless, deep skinned pink salmon logs could probably be sold at around \$2.25/lb.

The market potential for mince was also examined. In comparison to other minces, its market value could be expected at around \$0.80/lb. Initial market reaction to production was enthusiastic and price ideas were considerably higher, in the \$1.25 range. This may be explained in part by the different sources from which the mince was derived -- whitefish operations mince trim, collars, belly and other lower quality cuts, while the pink mince was primarily pin-bone trim (center of the loin) and soft fillets. A conscious effort was made to keep the pink mince very clean and high quality due to potential rancidity problems. A reasonable midpoint, assuming less meticulous grading of material, vacuum packaging, higher oil content and lower overall quality might be \$1.00.

The vacuum stuffed log concept was developed in response to rancidity and cost of packing concerns. Mince addition to the fillet logs was generally accepted though caution was expressed concerning the percentages. The idea received favorable reviews from the scientific committee and potential users if it would indeed solve the storage stability problem. Possible complications were pointed out, however -- metal clips cannot be used to tie the ends of the casings due to microwave tempering, and the logs need to be sawed in half (e.g., 16.5 lb/2, etc..) for some applications.

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Concerns were also expressed that some effort should be expended on evaluating market potential in food service and institutional markets for products in addition to working with national food companies. Clearly, a fillet with the pin bones pulled, rather than cut, would be an interesting product to test. Another valuable piece of information would be evaluation of price levels for reformed products marketed directly by seafood producers. Custom forming, vacuum packing and breading services are available in Seattle and the possibility of doing some independent market research on formed fillets is being considered. Product would probably be produced from both logs and frozen fish slacked out and reprocessed in Seattle after the season to evaluate the differences between once and twice frozen fish.

Concern was also expressed that using only once frozen fish would not be a realistic test as few plants are equipped to fillet in season. It was pointed out that there are at least seven shore-based fillet lines in Alaska now capable of producing pink fillet products in season. Each is capable of 1.0 to 1.5 million lb. for a total of 10 million lb. Some are dedicated to canned production, but there are also many floating processors. Someone producing cod during the winter could process salmon, and someone canning salmon could produce frozen fillets from fresh in summer or frozen fish during the winter. In short, there are ample opportunities to produce either once or twice frozen fillets.

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### **Excerpts from Advisory Committee Letter (September 30, 1986)**

The summer's activities got underway in Kodiak in late July, with AFDF, NMFS, FITC and Office of Commercial Fisheries Development (OCFD) cooperating on the design and sample preparation for a series of interconnected experiments.

#### **Kodiak Experimental Runs**

Approximately 2,000 pounds of round fresh pinks from Alaska Fresh Seafoods were dressed, and half were frozen for later reprocessing. The remainder were filleted and the pin bone section removed using a V-cut. Blocks of fillets, blocks of fillets with mince added at 25% and 50%, and mince blocks were prepared. Tests will be run to determine chemical and sensory changes in blocks held at 0° compared to blocks held at -30°, and to compare once frozen product to that produced from frozen h&g fish reprocessed at a later date.

Tests will be run comparing deep and shallow skinned samples, comparing vacuum packaging and poly bagging, and comparing different antioxidants. While the exact number of determinations to be run on the various sale sets hadn't been determined, there will be at least TBA's, thaw drips, and organoleptic tests run on each sample set at three month intervals. In addition, free fatty acids, total polar oxidation products, proximate analysis, oil and water contents, and PH' will be run as needed and as time allows.

#### **Experimental and Production Runs at Seafoods from Alaska**

The week at Seafoods was spent running yield tests using a skilled fillet crew and putting up vacuum extruded logs using a Vemag extruder. I bought 1,200 pounds of mince and fillet logs, and sent samples back to Kodiak for evaluation and storage life tests with the remainder going to Seattle for test marketing.

While there we determined the optimum diameter casing, choosing a 6.5" flat width as the best compromise. This will mimic one-half a 16.5 lb. fish block while also yielding a 4-8 oz. steak of suitable thickness (1 1/4-1 1/2") at 8.25 or 10 lb. net weight.

We also tried several mince and salt addition rates to determine their effect on texture. Mince additions of 0, 15, and 30% with 0, 0.5, and 1.0% salt were evaluated by an informal taste panel. The Seafoods staff felt that the all fillet product was clearly superior in texture, but that the mince didn't affect taste particularly. The salt level did affect texture, but, as for taste, it was a matter of personal preference. There was a difference of opinion as to the amount of mince to use, with one preferring to use as much mince as possible, the other preferring the all fillet product.

Chuck and I preferred the 15% mince with 0.5% salt to achieve the best economics and binding without sacrificing quality too much. At this level both the salt and mince are detectable, but neither should detract from texture or appeal to low salt users. We decided to run a larger test batch at NPP using the ribbon blender as opposed to the paddle blender at Seafoods, as the coating of mince on the fillets and elimination of obvious mince pockets should be superior.

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## Production Runs at North Pacific Processors

There were some experimental aspects to the production runs in Cordova. These included comparison of mince produced using a perforated drum deboner of 5mm hole size and a deboner/strainer which produces a much finer texture.

Another was the difference in binding ability and voids between logs produced using a vacuum extruder such as the Vemag and a piston pump such as used at NPP. Also of interest was the degree of protein activation and breakage associated with the ribbon mixer.

Qualitative observations are that neither the Vemag nor the ribbon mixer caused substantial breakage and that the combination of the ribbon mixer and the piston pump produced a fillet log that bound comparably to the vacuum extruded product with no voids in either product. The capacities and costs of the two systems are not comparable, however, as the NPP unit has 2-3 times the capacity at about three times the price.

Filletlets were produced on a Badder 195, a machine several companies have used to produce salmon fillets, but which gives lower yields than the current state of the art 184. The Baader Model 50 Skinner was inserted into the line, and the pin bones were removed using a top cut. The top cut and fillets were placed on separate moving belts and the fillets stockpiled until their turn through the stuffer. Top cuts and belly flaps were minced using both a Bibun perforated drum deboner and a Beehive deboner/strainer. Alternately, mince and fillets were packaged, sometimes using the mixer and other times loading the product directly to the screw conveyor feeding the pump hopper.

A 4" diameter horn with a foot activated cut-off valve was used which fitted the rest of the line well, but the horn size proved overlarge for easy control of the casing. A standard clipper was used to secure the end of the casing after patching to target weight. Obviously, having a portioner on the pump would have made even weights easier and more efficient to achieve.

Several problems associated with the production set-up became obvious, but due to space and time constraints could not be addressed. These centered on lack of space for trimming and inspection.

Due to the late and concentrated run, the crew trained to produce bone-in product for canning was very tired, and training the crew to produce bone out product proved difficult. Finding graders capable of spotting errant pin bones also proved difficult. The defect rate were marginally acceptable most of the time, worse at the start and better at the finish. Space was not available for the number of trimmers required to do the top cut unless the other fillet lines were shut down. This turned out to be a major problem the first day, but the second there was not enough fish to run more than one line anyway.

The largest unresolved problem is the high bacterial counts. According to preliminary work done at the FITC, nearly all the samples have TPC over 100,000 (for the 25° test). The high bacterial counts are probably due to slow movement of the product, repeated handling, and inadequate time/temperature control. These problems could be addressed through revising the line layout and providing a chilled space to work in, but this was not feasible on a one day run.

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Total coliforms were generally in excess of the reprocessing industry standard maximum of 100. High coliform counts probably indicate inadequate equipment sanitation and have been observed in other operations using automated filleting and skinning equipment. Inadequate cleaning allows the hardier coliforms to become the dominant culture which contaminates later fish. The coliform species identified are not in themselves health risks, but do indicate a problem. Fecals were generally quite low, indicating that the contamination is probably not of human origin. Unfortunately, the bacterial information was not available until after the run was completed due to the length of time required to transport the samples and conduct the tests.

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## **North Pacific Processors Final Report by Harmon Blanch Pink Salmon Fillet and Mince Log Production**

### **Background:**

The State of Alaska, through the Department of Commerce and Economic Development, proposed a pilot project to produce pink salmon in the form of frozen logs. The pilot had two objectives. The first was to determine if a salmon log, made from either fillets or mince, could be produced economically. The second was to produce enough product for a test market. If the project proved to be successful, the new product could utilize the abundance of Alaska pink salmon in non-traditional markets.

Since North Pacific Processors had the equipment to produce the fish logs and the projected Prince William Sound pink salmon run indicated that there would be an abundance of fish, we requested to participate in the program.

As we are now well aware, the projected pink salmon run did not materialize. The pilot project was rescheduled on two occasions, hoping the run was only late. Finally, in the latter part of the season, the decision was made to go ahead and over a two day period, the fish logs were produced.

Although the volume of fish was not as great as expected, the quality was good. The fish which were used to produce the logs were of the same quality as those which went into the Hormel skinless/boneless canned salmon pack.

The final report from North Pacific Processors Inc. covering cost accounting, fish quality specifications, processing methods and machinery, sanitation and general discussion of the problems experienced during, follows. The economic feasibility and a minimum price necessary to produce the fillet and mince salmon logs will be determined by the corporate office after marketing information has been reviewed.

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## **FISH QUALITY**

The first days' production utilized seine caught fish from Prince William Sound. The fish were brailled or rolled on board the fishing vessel and then transferred to a company tender and again at North Pacific Processors by means of a wet pump. A portion of the fish had slight to moderate bruising with some softening of the flesh. The general fish quality was typical of the catch method and time of year.

The second days production utilized aquaculture fish from the Port San Juan hatchery. Live fish were wet pumped from holding pens to a company tender and wet pumped again to the processing plant. The majority of fish were firm with only a small portion graded out due to pale flesh color. The weight range of the fish was 2 to 4 pounds with the average probably 2.8 pounds.

## **PROCESSING METHODS AND MACHINERY**

### **Dressing:**

A model "K" Chink, like those used for normal can salmon production, was used to head and dress the salmon.

### **Splitting:**

A Badder 195 filleter was used to split the salmon. The model 184 may have produced better results and slightly higher yields but due to equipment layout and production flow, it was not used.

### **Skinning:**

The skimmers used for the skinless/boneless canned salmon removed the skin leaving the fat layer intact. While this is desirable for canned salmon, it apparently is a detractant from the frozen salmon logs. To overcome the problem, the skimmer which was normally used was replaced with a Badder 50 deep skinner.

The Badder 50 was effective in producing an acceptable fillet but it was at the expense of product recovery. The skins produced by the Badder 50 were unusable for our other markets. Also, a usable product could not be obtained from the portion of the fish left on the skin. Without improved recovery, the price of the finished fat free logs may become prohibitive.

### **Pin Bone Trimming:**

Some logs were produced with a higher number of pin bones than the product form should allow. While even large bones are not a problem in a canning operation, pin bones in a frozen log become a major defect since they do not "cook out".

One reason pin bones were left in the product was that they are hard to detect through rubber gloves. Another is, the staff has been trained to be recovery conscious and the generous cut required to remove the pin bone section went contrary to their previous training.

The trim from the pin bone cut was sent to a bone extractor by water flumes. Even though the fluming water was chlorinated, the increased water content

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of the product and the greater surface area of the pieces undoubtedly increased the potential for bacterial growth.

If this operation were to become routine, the mince would be supplied by normally produced processing waste (belly cuts and center cuts) from the 184 and 195 Badders and the fillet trim would go directly to the skinless and boneless can line.

#### Mincing:

The deboning or mincing machines were not well suited for the purpose. The Bibun's pore size (5mm) was too large and allowed pieces of skin and eggs to pass through into the product. The Beehive produced a better quality product in general appearance but probably could not keep up with production.

Both units ran hot. The Bibun, due to heat transfer from the hydraulic drive and the Beehive due to motor heat and the heat generated by extruding pressure. The increased temperatures undoubtedly increased the bacterial counts along with the fluming system.

#### Fillet and Mince Transfer:

Three product forms were produced, 100% fillets, 100% mince and a combination of the two at a ratio of 85% fillets and 15% mince.

The products for the 100% fillet and mince logs were loaded from tubs directly into the Marlin hopper.

To produce a log of mixed mince and fillets, a ribbon blender was used. After an initial test run, it was found that the fillets and mince cannot be easily transported using a screw conveyor. Mince tends to get "lost" in the system and there is the chance of picking up pin bones from the fillets targeted for canning.

#### Stuffing:

A Marlin 770 stuffer was used to fill 7.5 and 6.5 in casings.

The equipment appeared to have worked well but upon slicing some of the finished product the logs were found to contain voids caused by air pockets. To reduce the air pockets, the Marlin stuffer should be fitted with a vacuum hopper.

It should be noted that there may be a disadvantage to a vacuum hopper in the canning line. If the air spaces are removed from the canned product, it may take on the appearance of a puck loosely fit into the can. This may also affect the loose texture and appearance.

#### Freezing:

The finished fillet logs should be frozen as soon and quickly as possible to keep the bacterial levels as low as possible. The product density and log diameter leaves a potential for warm spots in the core.

The mince production should probably take place in a cool room with a Bibun which has been modified to reduce the heat produced by the

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hydraulic motor. The increased surface area, heat of the equipment and additional handling makes the product susceptible to bacterial loading.

### **FINISHED PRODUCT AND RECOVERY**

The combined volumes of the two days production was

Fillet logs	5882 lbs
Minced logs	5246
Fillet/Mince logs	744
Total Production	11872 lbs

The recovery figures from the pilot will undoubtedly change and most likely improve as familiarity of the product increases. A rough estimation for the two days production was;

Split halves from the 195 Badger	48%
Deep skinned fillets from the 50 Badger	40%
Bone out trimmed fillets	24%
Top cut (minced)	16%

### **SANITATION**

The fluming system should be modified if it is used to transport food grade material. Also, it should be made to come apart for easy cleaning and inspection.

A foaming system should be installed in fillet processing area because of the high concentration of difficult to clean machinery.

A thorough cleaning should take place twice daily and wash downs using sanitizers should occur at breaks.

### **CONCLUSIONS**

This type of production is greatly affected by pinbones and I have doubts about its feasibility without the addition of a mechanical pin bone extractor. Without an extractor, the labor costs, the loss of recovery, and high defect rate makes the product economically prohibitive to produce when compared to skinless and boneless canned salmon.

## COST ACCOUNTING

	Staff	Hours	Wage	Cost	Subtotals
<u>Fish House</u>					
Chink hopper feeder	1	2	\$8.47	\$16.94	
Chink feeder	3	3.5	8.47	88.93	
Chink operator	2	3.5	9.50	66.50	
Inspector	1	3.5	8.47	29.64	\$202.01
<u>Splitting</u>					
Belly cut for 184	3	10			
Sorter for 195	1	10	8.47	84.70	
Operator for 195	1	10	8.47	84.70	169.40
<u>Filleting</u>					
Operator for 50	1.5	10	8.47	127.05	
Trimmers	6	10	8.47	508.20	
Trimmers	3	5	8.47	127.05	
Inspectors	1	10	8.47	84.70	847.00
<u>Packing and Misc.</u>					
Handling and weighing	5	3	8.47	127.05	
Mincer	3	3.5	8.47	88.93	
Stuffing & packing	5	2.5	8.47	264.68	
Egg sorting	1	3.5	8.47	29.64	
Cleanup		2 6	8.47	101.64	
Badder maintenance		2 3	8.47	82.00	
Stuffer maintenance				54.00	747.94
Quality Control		1 10	8.47	84.70	84.70
Total					\$2051.05

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## VII. CONCLUSIONS

## **Production Conclusions**

- Salmon blocks and logs from fillets and mince can be successfully produced from pink salmon harvested commercially in Alaska's common property and cost recovery fisheries. Fish that were not chilled on capture and supported in chilled water tended to be softer and to show more bruising, which required expensive grading and trimming to be used. Gillnet fish often showed bruising in the body meat as well. The best quality was achieved with champagne iced and RSW seine pinks.
- Freshness of the fish was not tested in any systematic way. Fresher fillets were firmer and if properly handled should have lower bacterial loads than older fish. Anecdotal information indicates that commercial production of mince for nuggets by Castle and Cook in the late 70's was highly dependent on the initial fish quality, though they used soft fish.
- Producing boneless skinless frozen salmon products requires filleting and removal of pinbones. There is an obvious tradeoff between fillet speed and yield and equipment cost. Operations have successfully used Baader 195 and 184 fillet machines, and some are now switching to the new 200 series machine. The range in cost is between \$100,000 for the 195 and nearly \$500,000 for the 200 complete with skimmers and handling equipment.
- Pin bone removal remains the principal labor cost and space problem. A large number of trimmers and inspectors is required to keep up with the faster automated fillet equipment. At present there are no proven mechanical pin bone removal tools available.
- Mince can be added back into fillet products up to 15% without significant change in texture. Finer mince mixed with a ribbon mixer coated the fillets the best. When extruded into logs this combination works quite well. Mince can be added up to 25% for some applications.

### **Yields from Suitable Quality Fresh Pinks**

Step	% drop	Resulting Yield, Ave. (round Wt. basis)
H&G	25	75%
Filleting	8-10	65
Belly bones/collars	12-15	53
Deep Skin	4-6	41
V-cut pin bones out	4-7	36
Trim	1-3	34
Mince recovery	4-6	

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Mince can be successfully added back at 5% of round weight with little affect, and up to 9% for some applications without compromising "fillet" mouth feel. These percentages do not tolerate sloppy V-cuts or mincing of the whole top strip of the fillet. Without a skilled crew a significant percentage of production would have to be minced.

- The fillet log product has significant advantages in terms of product stability, and few disadvantages for many applications where formed or chunk product will be produced. It is less labor intensive and lends itself easily to adding mince or other additives.
- The block market can also be supplied, but without additional cryoprotection, such as colder holding temperatures producers should be cautious about their ability to provide suitable product for more than six months. Reprocessed frozen fish can be used for up to three months without significant problems, but beyond that thaw drip became excessive. Together, these result in 9-10 months availability of untreated blocks.
- Holding h&g pinks for reprocessing at -20° F should reduce thaw drip and rancidity development. This lead was not pursued.
- Producers should carefully evaluate the results of the bacteriological tests. Most important to new frozen fillet producers are the possibility of non-pathogenic coliform buildup on filleting and mincing equipment that does not yield to conventional cleanup as practiced in canneries. It appears that addition of a caustic strip following foaming and high pressure washing is necessary. TSP has been suggested as an agent that would do the job. A rinse with highly chlorinated water should follow.

### **Marketing Conclusions**

#### **Food Companies**

- The market that was interested in 1985-1987 will need to be reassessed. The interest was there at the right price if production was steady. It remains to be seen whether the product can be produced at a price consistent with market expectations. Fish price is obviously critical, and some method for stabilizing prices is likely required to get major food companies interested again.
- Block products are problematic due to the need for cryoprotection. There are many other intermediate products that do not have this problem, and producers should carefully evaluate the end users actual requirements. Formed and chunk products do not require rectangular dimensions.
- More work needs to be done looking at users of chunk meat products, especially with the logs. Stuffed and pastry products, soups, and other possibilities abound.

#### **Foodservice**

- There are significant opportunities in the foodservice sector. This is probably the lowest cost and volume approach to introduction of new products.

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- The fillet log can produce a product that can be portioned at the serving site. Depending on the application, breaching can help mask the variable color that results from the lateral line.

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## APPENDICIES

Please note that contact people listed with participating companies may have changed since production and distribution work was completed in 1985-1987.

# DISTRIBUTION OF 1986 PRODUCTION

Client	Date	NPP Fillets 6.5 " logs 7.5" logs		Mince added 7.5"	Seafoods from Alaska Fillets	NPP Mince Bibun 6.5 Bibun 7.5 Beehive 7.5		
		2,000	6,000	600	1,097	1,000	4,000	1,500
Van de Kamps	1/13/87	112						
Food Service Test Market	1/9/87		1,250			800		
Ocean Beauty	5/1/87						250	250
Mrs. Pauls	5/1/87		56					
Rose Shrimp	5/8/87					280		280
Ore-Cal Patties	7/22/87						224 780	
Peter Pan Steaks	1/16/88		56					
NPP/McFarland	2/9/88							56
Seattle Seafoods Steaks and Patties	3/4/88	1,410	542 1073				179 118	23
Totals		1,522	3,245	0	0	1,080	1,776	609

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## **Appendix A**

### **Major Food Company Notes**

#### **Certi-Fresh/Gallati Bros.**

Carolyn Rotman

Larry Bates

13055 E. Mollett

Sante Fe Springs CA

213-921-8311

213-746-6201

213-744-1830

4/10/85

Larry Bates, Production Manager. Product Certi-lites, 300 cal portions of lightly breaded fish. 6 lines, including perch, cod, pollock, etc. breaded plus cod and halibut in light sauce.

Wes Morrelli, sales manager a key contact.

Note: Frozen muscle tissue can be formed, as it mats together, don't have to do block first. Blocks are hard to temper and saw. Forming crushes tissue, very hard on it.

Best Quality. IQF fillets temper, form. Labor savings- no sawing, much easier to temper. Production of 5-6 sawyers equiv to 4 punch press operators. Koppens is leading a revolution in industry away from blocks.

Koppen Industries Inc.

1625 South Rock Mtn. Road

Stone Mountain Industrial Park

Stone Mountain GA 30083

Mode 400 HD \$34,700

May need support on product development, small company. Larger companies can afford to do test marketing.

6/27/85

Wes Morrelli, Sales Manager. Is interested, getting plates in for Koppens, 2,3,4 oz filets. Wants to portion, offer out. Less intersted in nuggets. Want to investigate light breading or lemon/butter sauce.

Major restaurant in CA investigating salmon, hand cut portions too expensive, too wide variation in wt.

Retail - introduction too expensive until proven in institution. Looking at military commissary.

Want 1-200 lb for R&D, 500-1000 for next step.

Want cross layering, not long-pack, much easier to break up.

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10/7/85

Larry Bates. Wes in Dallas.

Price and availability - looking at \$2.50/lb <500,000lb. In 1 year could expand.

Problems - stability of retail products. Need 1 yr life on block, make finished product to order.

5/7/86

Bill Diedrich. Certifresh sold to Gallati Brothers. New phone . New contact Caroline Rottman.

Carolyn Rotman - Stan Dukesherer, President, interested in salmon nuggets

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## Gortons

Jim Ackert - retired  
Mike Wood  
Al WilliamsMatt Weber  
Ron Hadley  
Paul Naiman  
Gorton Group  
327 Main St  
P. O. Box 361  
Gloucester MA 09130  
(617) 283-3000

2/6/85

Interested in boneless skinless salmon blocks, both fat on and off. Will work on product specs, technical assistance.

Can't use block with lots of trimmings, V-cuts, etc. Less than 25% bits and pieces, tails < 2.5 oz, etc. Distribution of these pieces in the block is also critical.

Uses blocks by tempering to 18-20°F, band sawing to slabs, then using linear cutters. Not currently doing formed fillets.

There is considerable variation in flesh characteristics for salmon, requires extensive R&D.

3/1/85

Glynn Peterson, Tech Services. General Mills has an internal labeling requirement to list anything greater than 0.25% of finished product wt.

Haimmie - R&D. Wants mince blocks, samples of fillet trimmings, suggest two grades of test blocks, bright and dark fish. 2 blocks of each grade sufficient. Need oil content analysis, esp belly flaps and collars. Before packing trim, Cl<sup>-</sup> rinse and sodium erythorbate dip. Possible product is mixed mince and fillet trim.

3/12/85

NMFS Test Blocks - put up a master carton or two either 4x16.6 or 4x18.5 per carton. Gorton's will put in various forms for market analysis, 2 weeks to work up samples. If marketing guys like it, they will do marketing studies. If OK, Gortons will need 5,000 lb for test markets.

Gortons uses lots of minced blocks, may want to look at laminated mince/fillet blocks. Poly bagged in master carton, 5 mm screen. Test for bones by running into beaker of water, stir, bones settle out.

Needs to know volume and anticipated prices.

Cod sets prices, Grade A \$1.03 CIF Gloucester

6/19/85

Evaluation of blocks from Seattle NMFS test run.

Question concerning wt. Usually want 4 oz over, crowning thereafter is a function of plate freezer. Drain fillets, pre weigh fish, throw handful into ends.

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Bones - as long as bones are non-hazardous, should be OK.

Voids - quarter size 1/8"-1/4" deep are major

6/27/85

Only International Seafoods of Alaska has right frames in Kodiak. Need Dansk or Beck frames. Use Baader 50, sharpen blade.

Tony Apell, Mike Wood - International sourcing, alternate contacts est 300.

7/31/85

voids -- 4 oz overflow will work, but using phosphates to reduce drip loss probably better.

Check into Lemophos, Gene Brotski, Stouffer Chemical 412-228-7510. Product developed esp. for salmon. Works well on cod and sole. Also look at FT-80AD.

Wants mince product to test as well.

10/11/85

Gortons is doing concept testing on salmon tray pack portion. Breaded items not well accepted and salmon too expensive. Rollout would require 1 M lb, \$3-5 M adv. costs.

R&D doesn't want deep skinned due to omega-3's. Looking at freezing in sauce -- flakes nicely. Product tested well, comparable to Norwegian.

They want copies of four pictures to send to General Foods (parent co.)  
Demographic data on salmon consumption.

Norwegians offering blocks at \$2.36 FOB Norway, \$2.44 East Coast.

85% to h&g

56% yield h&g to boneless skinless fillets

Equivalent to 48% from round

11% mince trim

Other competitors likely to be Chilean coho and Japanese chums.

8/19/85

Interested in logs and will help with costs by paying for product.

Has been contacted by a broker in Seattle interested in providing salmon nuggets cut from fillets by hand, twice frozen.

Interested in waterjet technology, cutting fillets, portions.

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## Hormel

John Vrabel  
Product Marketing Manager  
Grocery Products Division  
P. O. Box 800  
Austin MN 55912  
(503) 437-5770

8/5/85

Hormel putting up boneless skinless canned product. 3 yrs in development. Production manager is John Vrabel. Did look at producing in Alaska. Basically no one was interested.

From frozen h&g, filleted in Seattle at Seafreeze and trucked to Minnesota. Mel Donaldson of Windjammer is handling production. Price Seattle \$2.00-2.05/lb. Windjammer has contracted with Security Pacific Trading to contract processors to produce h&g. (Tony Burget is now head of SPT)

2 pc cans, 6.75 oz net for both regular and smoked. Same size and label as canned chicken, ham, turkey.

Initial distribution pickup going well. Started shipping last week, setting a number on pounds of production now.

R&D Gary Ray. Would be interested in looking at product.

10/9/85

Meeting in Austin.  
Jim Hall,  
Bob Patters, Groceries  
Jerry Figgenstow, Marketing  
Gary Ray, R&D  
John Vrabel - team leader

### Agenda

- History of Hormel project
- State's position and how this project fits in
- Slide show and discussion of product

Discussed AIDA, grounds prices and complexities of operating in Alaska, knowing what the price and quality of product is.

Acceptance very good, reorders 40% smoke, 60% regular. 92% acceptance after introduction, 71% though it was clearly better than traditional. Introduction is getting people who have never tried salmon. Some letters rave, most who take time to write don't like it. SEE POINT OF SALE INFO.

10/23/85

Follow up with Jim Hall, John Vrabel, Jerry Figgenstow.

George A. Hormel interested in doing production in Alaska, no producers were interested. Peter Pan spent most time, decided product wouldn't sell. Talking to Metlakatla now.

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Currently using PWS RSW seine fish frozen on floaters. Bought 4 M lb this year, yields 200,000 cs on 300,000 case permit.

George A. Hormel feels good about quality now, good chunks, though regular is dry. It sets up and must be flaked with fork. I questioned processing method as fillets come off line at Seafreeze at 50° and are packed in 150 lb wetlocks, palletized, and put in refer van, 3 days at 29° to Minnesota. Can't cool off much, high drip loss likely.

Smoked has oil added, is more flavorful and less dry. Quite good. Processors consider this a real challenge.

10/31/85

Rick Bross - Production manager for product

Hormel finished FY, record for both sales and profits. Salmon projections are on target.

Had recent session with Pillsbury and General Mills reps. They really liked it, feeling upbeat about it.

4/28/86

John Vrabel. Contact Gary Ray, handles arrangements to produce pack. Wants to put made in Alaska on can. Preference is to move when fish is in can with promotion. Send letter to Hormel with qualification criteria for made in AK.

7/12/86

Don Gordon, R&D Hormel, Interested in logs, wants to know price. Discussed project generally. Russ Potter another contact, responsible for co-packers.

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**Mrs. Pauls**

Dick Baker  
President  
Mrs. Pauls Kitchens  
5830 Henry Ave  
Philadelphia PA 19128  
215-483-4000

**Product Development:**

Betsy Turner  
Barbara Belkin  
Dotty Farley

8/7/85

Marliyn Haskian - please send samples of blocks attn Betsy Turner. Ron Lane is head of product development and technical services. Pin bone out, skin in, no preservatives.

Mrs. Pauls buys Polish product. On-board processing has lack of inspection space. Leads to problems.

South Korean product has hundreds of women picking out bones and parasites. Though twice frozen, defect rate very low.

Mrs. Pauls works quickly with blocks to get product coated, control rancidity.

5/27/87 - Roger Shnorbus, VP Operations

MP very interested in logs of fillets and mince. Want market research data and pertinent cost estimates.

June '87

**Shipped:**

Lot F23686	6.5: fillet logs	56 lb
Lot B23686	7.5 mince logs	56 lb

Jim Daniels  
Mrs. Pauls R&D Lab  
5501 Tabor Rd  
Philadelphia PA 19120  
215-535-1151

10/10/87

Mrs. Pauls reports quality of product excellent, better than Domsea's, esp color, texture, moistness. Quality most important to Mrs. Pauls. Price will follow.

Twice frozen may be useable, but much more interested in top quality.

Liked mince and fillets, used in hor's douvers, pastry wrapped, used Koppens former to shape. Any products likely to be chunked salmon. IQF chunks may be of interest.

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**Peter Pan**

Rick Muir  
Peter Pan Seafoods

Seattle WA  
206-728-6000

1/24/85

King Cove production. Lloyd Guffy. Filleting - Baader 195, capable of ~750lb/hr. Yield 63% from round to skin on, collars and fins off fillets (sockeye). Selling squared off, portioned fillets in finished vac-pack, sockeye and chums. Saving tails, tips, rib bones for sale to Japan (flakes).

2/19/85

Chum fillets, portioning at King Cove. Belly strips available. Possible to ship in frozen trimmings to Kodiak, mince and stabilize there.

3/18/85

King Cove - have 2 hydraulic plate, blast and brine freezers. Cryovac tunnel for whole fish, Multivac roll stock for portions. Can all pins that come in.

Wants to know about project, as they are intersted in an alternate market for trim. Asian market will absorb an appreciable volume, but not a long term solution. ~100,000 lb market.

Current problem, \$0.50/lb trim.

10/2/85

Freezing is not a limiter for pinks, canning line is main focus though. Alternative is round frozen (brine). Can do 850,000 lb/day can, 350,000 brine.

Need a major contributor to volume, probably expanding canned. Have access to \$1-200,000 for capital expenditures. Interested in 695, 3,000 lb/hr. Interested in block frozen, remove top strip for mince, block freeze bottom. Use both fresh pinks and watermarked chums.

1/21/87

Rick Muir. Distributors not moving fast enough. San Francisco intereseted depending on response.

6/5/87

Seafoods from Alaska wants to work with Peter Pan. PP markets, SFA produces. OCFD products were sent out, 100% fillets. Plan on offering customers 15% off to see if price reduction increases sales any.

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**Ralston-Purina**

Bill Reinke  
Director R&D  
Ralson Purina Inc.  
One Checkerboard Square  
St. Louis MO

314-982-1633

1/16/85

Internal ASMI Memo. Ralston Purina introducing boneless skinless canned pink salmon under Chicken of the Sea label, test marketing in upstate New York, western Penn, Miami, Kansas City, and Houston by mid February.

\$7 million campaign according to Advertising Age (12/31/84), with \$4.2 million for network and spot TV advertising and print ads in women's magazines. Unknown duration.

Water packed SE pinks frozen on floaters. There is apparently no indication of Alaska origin on cans. Frozen product apparently purchased on open market. No indication R-P has an agreement with an Alaska producer.

Packed at a tuna facility on Terminal Island. Standard tuna pack 6.5 and 12.5 oz cans. Initial test amount equivalent to 100,000 cs 48x6.5. The 6.5 oz cans may contain as little as 4 oz, with the remainder water added, which is consistent with tuna packing standards but does not meet FDA canned salmon standards. R-P has applied for FDA permit to test market as canned salmon.

Listing price \$61-63/cs (48 6.5), with a promotional allowance of \$12/cs. Effective wholesale price ~\$50/cs. Traditional 48 1/2's are going at \$38-40 with discounting.

R-P plans are not public, but it appears the company is considering packing production quantities at a tuna facility in Puerto Rico, which would significantly lower the labor costs.

**Seafood Trend article**

Jan. 16, 1985 Vol. I No. 14

**CANNED SALMON: VAN CAMP WILL INTRODUCE SKINLESS, BONELESS**

Van Camp's seafood division will test skinless, boneless canned pink salmon in five major markets this Lent under its Chicken of the Sea label, the first major market innovation in this industry since the two-piece can. News of the program has caught the Pacific Coast canning industry by surprise.

Ramifications could be great. On the plus side, a major food corporation will spend heavily to promote an innovation that's been talked about for years. On the down side, there's the real possibility that the processing will be done overseas.

Van Camp's marketing department politely referred most of our queries to their attorney, but here's what we've pieced together about the product, its production and marketing:

The product is packed in standard 6.5-oz and 12.5-oz tuna tins labeled "Skinless Boneless Pink Salmon. Chunked Style In Spring Water. Net weight (6.5 or 12.5 oz.)" It's believed that a 6.5-oz can contains about 4 oz of salmon.

FDA standards require minimum 6.75 oz salmon in can the size RP is using (307x113). RP has applied for and obtained a temporary permit.

Rumors that the salmon was either processed in Taiwan or processed from salmon purchased from Taiwan have proved false. Canning was done at Pan Pacific Seafoods in Terminal Island, CA with 1.8 million lbs of frozen headed and gutted pinks purchased from a Seattle processor.

A technician familiar with the machinery and processing methods available thinks that recovery rates for chunked style pink salmon are 40-45% from round weight. Assuming a case of 48 6.5-oz cans contains 12 lbs of salmon, Van Camp processed the equivalent of about 100,000 48-short cases.

Info from canned brokers indicates that a case of 48 6.5-oz tins will list between \$61-\$63. But a \$12/case promotional allowance will bring the net cost to the \$50 level. By comparison, net price/case on pink 48/halves is \$38-\$42 right now.

Van Camp will spend \$7 million on advertising and promotion if the program rolls out nationally. \$4.2 million of that will go to network and spot TV ads and to national women's magazines. Van Camp will not say what portion of the advertising money will go into the test markets.

Product should reach store shelves by mid-February in upstate New York, western Pennsylvania, Kansas City, Houston and Miami. Our supermarket shoppers network says that product has not yet surfaced in any of these areas.

**Industry Reaction**

Alaska salmon canners were more than a little stunned by Van Camp's move. As one veteran who's close to both the tuna and salmon industries put it: "It's hard to believe--in this industry--that they kept it a secret so long."

The immediate worry is whether the Van Camp product will cannibalize market shares of other canned salmon, or, as the company's internal sales literature suggests, attract new customers to the overall category.

Nor is it clear which specific category would be impacted most. Assuming that our information about Van Camp's pricing strategy is correct, grocers could buy 12.5-oz chunked style pinks for about \$0.47/can less than the current average price on 15.75-oz red salmon. They could buy 6.5-oz chunked style pinks for about \$0.18 over the cost of standard pink halves.

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According to our current wholesale estimates for canned product, the grocer's per can product price spread looks like this: red talls=\$2.33; 12.5-oz chunk pink=\$ 1.86; pink talls= \$1.46; red halves=\$1.40; 6.5 oz chunk pink=\$1.04; pink halves=\$0.86.

Lon LaFamme, executive v.p. of Evans/Kraft, the advertising agency that handles the Alaska Seafood Marketing Institute account, may have summed up the Alaska contingent's initial response well.

"We're entirely cognizant of the financial stress in the industry, and this could worsen it," he said. "But canned salmon has needed something like this to expand our market from the 50-plus age group to 'the yuppies.'"

First, he says, is the unanswered question of how good the product is. If the product proves out, he notes, "then from a marketing standpoint, this could present more opportunities than problems for the Alaska canning industry."

Van Camps internal sales literature spells out the marketing angle: "the industry does not appear to be meeting the needs of younger consumers. .. a tremendous opportunity exists to market canned salmon (similar to) tuna..."

#### The Puerto Rico Connection

Beyond a near or medium term threat, Alaska packers have a worse fear. Does Van Camp's move signal the start of an off-shore exodus for the salmon canning industry that will mimic tuna's plight?

At first glance, the proposed of shipping frozen pink salmon to Puerto Rico, and canned salmon back again, might seem silly. But so too does the prospect of canning them in southern California. Both scenarios deserve careful study.

Those who are quick to argue the impracticality of Van Camp's taking the operations to Puerto Rico or Samoa raise freight costs as the central issue. This argument should be thoroughly scrutinized on two counts. First, it's our understanding that shipping costs for canned tuna from Puerto Rico to the East Coast (about \$0.15/lb) are about half of rail costs to ship product across the country. Second, opportunities for shipping salmon in bulk on Alaska coastwise freighters may make export shipping costs workable.

3/15/85

Ray Cesarini. Seahawk Seafoods supplied Van Camp's fish.

4/1/85 Chris Mitchell, AFDF

Contact Bill Reinke, R&D director on St. Louis. VC has closed down all operations in San Diego except some fleet maintenance, political office.

Van Camps packed salmon at Pan Pacific plant on custom basis.

4/18/85

Bill Reinke. VC interested in being secondary processor, not primary production of salmon. Won't be filleting.

6/20/85

Bill Reinke. Talking to AFDF, intersted in fillets. May use fillets blocks to can, frozen to reformed. Interested in Koppens former.

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7/16/85

Letter from Reinke. Interested in blocks, considerable freight advantage, plus lend itself to new product development. Product quality and consistency across primary producers key for secondary processors. Other critical factor is cost/lb. Estimate one month necessary for in-house evaluation of samples.

2/4/86

Wants to look at fresh b/s fillets, also twice frozen possibilities, affect on quality. Handling standards. Looking at flatfish, talking to AFDF. Work with Rod McLacklan in Seattle, 206-284-2051 (with Sea-Alaska).

6/13/86

Bill Reinke Not decided about fillet logs yet for use in boneless skinless canned. Interested in serving on advisory committee.

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**Van de Kamps**

Bill Diedrich  
Vice President, Purchasing  
Van De Kamps Frozen Foods  
P. O. Box 1451  
Long Beach CA 90801  
213-921-5764

Alt. Contact Don Busby

5/30/85

Ship test blocks from NMFS lab to Long Beach.

6/23/85

Generally product has distinct possibilities. Shelf life is critical. Need protection to be 6-9 mo life as block. Pack skin in to avoid rancidity development.

NMFS Block Evaluation from lab

No mince

Lateral fat line up to 2" wide

up to 5-6 pin bones, 7-8 to block

Some fillets soft

Color - no obvious aging

Minor skin

Fillets laid into block nicely

Mince added blocks

Essentially same as fillets

Some dehydration, probably from packing with dry ice  
weights low

Screen size larger than desirable, too large of pockets  
suggests tumbling fillets with mince to coat uniformly

Cost needs to be \$1.80-2.00.

10/8/85

Need to lay out bacteriological findings

Rancidity control in retail important

Van de K very interested in mince due to low cost.

Interested in working with refrozen product. Need some trial runs. Co. works with refrozen, processed overseas satisfactorily.

Recap.

VdeK interested from the beginning. Co. buys most of their product from Japan and Korea. Japanese interested in selling salmon blocks. Most interested in regular, long pack blocks, mince.

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Not overly sensitive about twice frozen, most Korean product they are buying is reprocessed.

11/25/85

Products from Erie plant looked very good. Both fillet and mince products, lightly breaded. Particularly interested in mince - mild flavor.

2/6/86

Looking at Korean product reprocessed and cryovaced.

Lots of concern in VdeK about shelf life. Considering farm raised salmon due to shelf life questions.

Interested in blocks remaining in storage. Want 100 lb from Seafreeze.

5/12/86

Sent raw product back east without coating. Won't have a west coast cutting for a while. Using the same technique as with light breaded product - live temper, then formed log in fillet shape, cut. using Becher Press.

1/7/87

Ship logs to Erie for arrival Tue or Wed for Becher press tests.

VdeK installing press in Sante Fe Springs plant.

VdeKFF

13100 Arctic Circle

Sante Fe Springs CA 90670

213-921-5764

5/11/87

Fillet logs worked well in Becher press at Erie plant.

11/19/87

As of July, VdK has gone through integration into Pillsbury. Most projects are on hold, and will have to go through prioritization. Marketing group in Minnesota will decide. Interest is there, depth unknown.

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## **Appendix B.**

### **Market Leads and Information**

- |         |  |   |
|---------|--|---|
| 1/17/85 | Jim Barr<br>QC Manager<br>Icicle Seafoods  | <p>New England Fish Company mince blocks, salmon patties. Conclusions - most critical factor is preliminary treatment - pack variables, <u>storage time and temp.</u> Antiox only slight improvement. Sources Canfisco Vancouver, collar cuts, hand cleaned (too expensive) and minced, and Pier 65, frozen cannery pinks and chums, split and minced, <u>not</u> blocked. Other sources proved unsuitable.</p> <p>Ship Ahoy patties straight salmon w/ potato flakes, breaded and deep fried. No other fish, bland flavor. Made up patties every three months. Patties seemed to improve in storage. Up to 15 mo shelf life starting with very good material.</p> <p>Started retail, moved to foodservice.</p> |
| 1/29/85 | Galen White<br>Pelican Seafoods  | <p>Was on Alaska Enterprise when Arctic Alaska did pollock mince experiment? with NMFS. Looked at super chilled tumbled fillets into Koppens former to get binding. But chose sausage casing due to cost.</p> <p>Also when AA did pinks in PWS. Copuld have made more \$ doing H&amp;G due to yield loss on flaps. Shatter packs worked well. Trimming bellies off cut recovery 13-17%, made good mince. Set price at \$2.05, started at \$2.10-2.25</p>  |
| 2/5/85  | Lewis Litzen<br>Happy Fisherman<br>29 Sutherland Rd.<br>Brookline MA 02146<br>617-232-6618 | <p>Has established NE markets for kosher mince salmon products - chowders, croquettes, loaf, gefiltefish, mostly formed and breaded products.</p> <p>Bought 10,000 lb Arctic Alaska belly trimmings at \$0.85/lb, another 22,000 lb available, made mince with Baader 694, 18.5 lb blocks. Wants block at .85 delivered Boston. Working w/ NMFS Gloucester lab.</p>   |

- 3/6/85 Eydfin Tausen  
Alaska Factory  
Trawlers Assoc. Producing pollock nuggets using Dutch  
Koppens former. Nuggets, 1.75 and 4 oz  
fillets, 25% breadding. Price \$1.45-1.75/lb.  
Certifresh in LA buying a Koppens.  
Storage temperature ideal -40°C. -20° charge  
0.4¢/mo.
- April 85 Ken Wong  
Sea-Tec  
Suite 302 Fisheries  
Bldg.  
4241 21st Ave W.  
Seattle WA Was Castle and Cooks/Pan Alaska QC  
manager for salmon nugget project. Used  
trimmings from skinoff portion controlled  
fillets. Price too high on fillet mince. Semi  
and dark chums mostly left over from frozen  
sales, some fresh (fresh much better). Spent  
\$2-3 million at Bumble Bee/Astoria,  
Warrenton, Pan Ak. Product wasn't first  
class, too expensive for institutional trade. Big  
market for mince loaf and nugget at right  
price, but must have continuity. Started to  
move loaf in volume at \$1.50/lb '80-81 to  
inst. market, 5 lb blocks, total volume 0.5 M  
lb.  
Problems with backbone mince stability, 6  
wk - 3 mo shelf life, must cook. Tried  
erythorbate, TBHQ, got 6 mo. max. Tried vac  
pack.
- April 85 Nils Dragoy  
Trident Seafoods 17M lb mince salmon used in UK in '84,  
mainly as byproduct from smoking, for fish  
cakes. Wants to mince whole water marked  
fish w/ good meat color at Akutan, use  
surimi equip. Shumagin or False Pass pinks.  
Interested in pink and chum fillets for Eng  
and German smokers. Maybe San Juan  
Seafoods will be doing some in Seattle.
- 5/5/85 Ken Roemhildt - NPP. Made proposal to Hormel, accepted.  
Want to do additional fillets beyond what's  
needed for Hormel. Prefer to do IQF, use  
spiral freezer from Gibson Cove. Looking at  
getting three 184's, can do with two. Very  
expensive. Have a 195, can get three. \$65,000  
purchase for one, \$40,000 on \$10,000/yr  
lease.

10/21/85	Bert Pfeffer President ITA Corp Fishermens Terminal Bldg. C-10 Seattle WA 98119 206-7097-7097	<p>ITA marketed Arctic Alaska's production from PWS. Sent 12 samples, five showed interest, esp France, Belgium and Holland.</p> <p>Sold to Swiss smoker 120,000 lb. Three problems. Price high at \$2.45, some soft, some undersized (&lt;350g).</p> <p>Surveyed 85 European fish buyers about salmon fillet program. 22 replies, including 12 smokers, 7 retail cos, 3 institutions. Main interest cohos 350-450 g, some interest in brite skin on chum. Some smokers want fillets to 1 kg.</p> <p>Pinks, smokers want over 350 g w/ out belly flaps, institutions want 200g+ fillets.</p> <p>Freight costs and 15% duty main obstacles. Costs are \$0.23/lb for fillets. 20' container holds 30,000 lb shatter packs vs 17,000 lb h&amp;g. Need \$0.12-13 to be competitive.</p>
10/15/85	Nils Dragoy Trident Seafoods	<p>Definitely intersted in filleting salmon, will only have 184, Mid April-mid May only (no pollock or cod). Looking at 15 lb shatterpack block, maybe 16.5 block.</p>
6/27/86	Bill Woods Sea-Alaska/Con Agra	<p>Looked at Armour (Banquet line) frozen dinners. Fillet to formed portions. Had shelf life problems after portioning. Lack of enthusiasm for expensive unstable product. Big problems is temperature cycling in retail freezer. Leads to rancidity development and dehydration. Didn't use any glazing.</p>
Fall 86	Neil Todd, Windjammer Seafoods	<p>Making breaded salmon nuggest from chums. Interested in producing: Breaded cut fillets or mince patties from logs Cut fillet logs layered in vac pack boil in bag with sauce - 200 lb Formed fillet or mince - coated - 200 lb.</p>

1/7/87	Eydfin Tausen Alaska Trawlers Association	Interested in pink salmon fillets. Working with value added pollock now, want to do as much as possible onboard, though can do on shore as well. Want to substitute pollock for other species, add new lines of products. Working on machine cello wrap for fillets, now doing it be hand. Working on bone detection methods, trying to get Lumiscan (flourescent) unit to tryout. Working with Hormel, Stouffers, Gortons, Van de Kamps/Pillsbury, Gallati Bros/Certifresh, Avalon Bay, General Mills, Kraft.
1/8/87	John Hewitt Ken Roemhildt NPP Cordova	Beehive fillet mince in use in Anchorage federal cafeteria operated by NANA/Mariott Corp. Have used 350 lb, could use 450. No problems with stability so far, packed in 5 lb scallop boxes. Contact from Rose Frozen Shrimp - wanted mince at \$0.85-0.90, NPP needs \$1.25/lb.
7/16/87	Ore-Cal Avito Muñoz POBox 12249 634 S. Crocker Los A. CA 90021 (213) 680-9540	Ordered 4 cs. mince patties shipped via Federal Express in styro/dry ice. 7/22/87 Ordered 250 lb mince and 780 lb mince patties at \$1.00/lb. Shipped via Federal Express.
2/9/88	Rae McFarland, Farland Foods 9100 South 500 West Sandy UT 84070 (801) 561-4211 via John Hewitt NPP	No longer with Beehive, has plant outside Modesto CA. Really interested in product. Release 1 cs 56 lb of logs.
86?	Pete Dewaters Rose Frozen Shrimp Inc. 541 Ceres Avenue Los Angeles CA 90013 213-626-8251  Anchor Foods Los Angeles CA (213) 724-0202	Mince is selling, supplied by Seafoods from Alaska. One container load sold. \$1.50-1.75. Salmon patty sold in Salt Lake, Idaho, Pennsylvania, Iowa.  Institutional feeder contacted Alaska Fresh about blocks

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### **Production Notes**

**Dec. 1984. John Lecture - Seafood Producers Coop. Formerly with New England Fish Co., Domsea.**

Domsea producing 5 lb vac pack mince product, blending dark pale and marbled chum. Used in Swanson Le Menu items - stuffed founder fillet.

NEFCO nuggets, salmon and pollock, shrimp and pollock, crab. Over 50% of sales salmon. Contact Ken Wong, Seatec. Used pinks and chums

Look into Castle and Cook salmon croquettes.

**Prince Rupert Fishermens Coop - Bob Jongeward and site visit  
604-624-2146**

#### **Capacity**

- 5-600 tpd total freeze
- 250 tpd brine - for herring
- 200 tpd blast
- 50 tpd plates, tunnels, 2 Cryovac air blast for IQF
- Automatic fillet sorting by size.
- 2 Trio skinners
- 2 Baader 51's
- 2 Baader 50's
- 2 Baader 47's
- 2 Arenco

Unload with 10" wet pump into 6x30,000 RSW holding tanks. 6 sta sorting line. 3 fillet lines of 20 hand filleters each. Ave filleter 130-150 lb/hr. Paid hourly at C\$13.30 = \$10/hr.

Plant does major block volume, have 500,000 lb of groundfish on floor now - perch, sole, snapper, turbot, pollack, skate wings, etc.

Did salmon blocks last year, pin bone in, semi-deep skinned. Recovery 36-37%, 42-44% skin on.

Fillet without heading or gutting. Cuts - collar, split to tail, separate collar and top of fillet, belly cut, bone cut.

QC. No rancidity control necessary. Basket sterilization - 100 ppm Cl<sup>-</sup> dip tanks. TPC max 300,000, bones 1 / fillet limit. Cleanup 4 people for 8-10 hours daily.

High pressure washdown, alum cleaner, Cl<sup>-</sup> wash and foaming agent. Eight ppm Cl<sup>-</sup> in process water.

Capacity 150,000 ppd in blocks. Product went to Canadian smokers.

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**6/24/85 Jan Onerhiem, Seattle Seafoods**

Interested in pink blocks, doing halibut, salmon, swordfish custom processed blocks now. Does business with Alaska Fresh.

Initial response negative with salmon block, rancidity. Inherited Skippers line of chum salmon nuggets from Pan Alaska. Cutting out tenderloin nuggets above lateral line, hand filleted 6 oz vac'd skin on salmon steak below lateral line.

Doug Wallach. Worked on TV dinner product, had rancidity, dehydration problems.

**10/2/85 Jan Onerhiem**

Not interested in mince.

Vacuum packed fillets not moving well., especially in smaller sizes. 8 oz best, 6 distant second, 4 not moving. Problem may be vac pack, customer wants tray pack. Foodservice trial at military commissary bombed.

Looking at reformed products, talking to Trans-Pacific.

Particularly interested in block pack frozen fillets individually vac'd.

**3/4/88 Gordon Lowell Seattle Seafoods**

Took over entire remaining inventory of log products and formed steaks and patties - 3,345 lb.

**1/8/87 John Hewitt, Ken Roemhildt, NPP Cordova**

Contact from Rose Frozen Shrimp - wanted mince at \$0.85-0.90, NPP needs \$1.25/lb.

**1/8/87**

**Jean Brotski,  
Stouffer Chemical  
1130 E. Maiden St.  
Washington PA 15301  
Phone 412-228-7510**

Lemophos costs \$0.70/lb, solution 1 lb/gallon, (10%), for dip.

Application - flex for 1 min, uptake 5% by weight

Should increase yield, help color, minimize curd formation on cooking.

Freezeguard 808E an alternative, developed for mince

Mix 1.5 lb/gal, add 1% as solution

9 months of evaluation for flavor and TBA, comparing vacuum pack and TBA.

Vac      Good color and low TBA

Texture got chewy

Flavor went bland

Lemo    Some TBA buildup

Some loss of color

Texture held up well

Flavor variable.

Effects of Lemophos

Mixing with phosphate would increase protein extraction, but would reduce drip loss and may allow addition of extra water. May help reduce rubbery texture.

### 1985 Production Information

#### Yields

Silver Lining - hand filleting pinks, ocean run, 9/18/86

hd off, gutted 75%

rib out, collar off, skin on 56%

Ore-Aqua - headed and gutted after stunning, iced and air freighted to Seattle, filleted on Baader 185 at Seafreeze, Baader reports 59% with collar off 40% with shallow skinning, pin bone removed

Alaska Fresh - fish, dry iced, 8/22/86, round weight 1371 lb

fillet blocks	10@ 19.2	192	14.0%
mince blocks	8@ 19.2	154	14.9%
trimmings		53	
Total		399	28.9%

Test run 100 lb round

Fillets out of Lapine 56 56%

Belly bones and collars 45 45%

Deep Skinned 32 32%

Alaska Fresh - Venturess fish, 10,628 lb round, champagne ice, 8/22 - 8/23.

Skinner broke down and last approx 1500 lb of fish went straight to deboner.

Fillet blocks	10 @ 19.1	191	
	42 @ 19.0	297	
	20 @ 18.9	378	
	19 @ 19.0	360	
Total Fillets		1,226	11.5%
Mince Blocks	8 @ 19.1	154	
	20 @ 19.0	380	
	16 @ 19.16	307	
	32 @ 19.09	611	
Total Mince		1,452	13.7%
Overall Total		2,678	25.2%

Prince Rupert Fishermen's Coop - Hand filleting, bellies removed, pin bones in, skin off Trio skinner - 36%

Jerry Babbitt, NMFS Utilization Lab, Kodiak - Hand filleting dark chums

Dressed	75.4	100%
planked fillets*	67.0	
Backbone	10.2	
Fillet Mince	40.7	
Backbone Mince	4.6	

\*includes belly bones, collars and fins

## Drip Loss and Voids

2 oz. water addition to CW lot 8/15/85  
extra patting on C lot

	Lot	Drip Loss	Ave Wt.	Ave Wait	Maj. Voids	All Voids
22685	A		19.4		4	9
	B		19.12		6	12
22785	A	2.7	19.02	9 hr	13	22
	B	4.1	19.06	6	9	19
	CW	2.5	19.15	5	16	21
	C	3.3	19.16	2	10	19
NOTE: Switch to every two hour freeze, no water addition,						
23585	A	4.6	19.05	2	8	12
	B	4.6	19.00	2	3	17

### Conclusions:

1. Freeze every 2 hrs to keep variation in wts down, and help with voids. May help to squeeze for a time without refrigeration on to remove voids also.
2. Drip loss looks acceptable in all cases (less than 7%).
3. Voids seem to be related to free water and drip loss, though adding H<sub>2</sub>O to block does not appear to reduce voids. Reduce basket weight from 19.4 to 19.2 lb to keep weight down and reduce crown. Wt. should end up around 19.0-19.1 lb.

### DRIP LOSS DETERMINATIONS

Lot No.	Frozen	Thawed	Drip Loss	8/15/85 Average loss
22785A	78.6	76.8	2.3	2.7
	78.3	75.9	3.1	
22785B	83.6	77.8	5.8	4.1
	81.1	79.1	2.5	
22785CW	80.1	78.8	1.7	2.5
	78.6	76.0	3.4	
22785C	80.6	78.3	3.2	3.31
	78.7	76.1	3.4	

### DRIP LOSS DETERMINATIONS 8/23/85

23585A	83.3	79.7	4.4	4.6
	81.0	77.2	4.7	
23585B	84.8	80.3	4.9	4.6
	77.0	73.8	4.2	

### 1985 Product Shipping

<u>Date</u>	<u>Lot No.</u>	<u>No. Cs</u>	<u>Cs. No.</u>	<u>Destination</u>
9/18	not ent.	3 (part)	12, 29, 30, 45	Samples pulled for Bact, Lots 20785, 22685, 22785, 23585
9/18	not ent.	2	29,30	Samples for Ted Otness
9/18	not ent.	6	45-50	Evaluation Samples
?	06138-10	1	44	Nils Dragoy
2/22	06138-10	14	31-43	Van de Kamps
4/15	299649	2	net 36	Harold Barnett, WOPCO
	299648	2	net 40	

### Steak and Patty Yields from Logs

Incoming	Fillet logs	1,519.0	56%
	Mince logs	1,199.2	44%
	Total	2,718.2	
Product	4 oz steaks	937.0	
	6 oz steaks	249.0	
	3 oz patties	988.0	
	Total	2,174.0	
Waste	Fillet ends	191.0	13%
	Mince ends	165.0	14%
	Sawdust	98.0	4%
	Overall	454.0	17%
Yields	Fillets		
	yield	1,186.0	78%
	acct'd for	1,431.8	94%
	Patties		
	yield	988.0	82%
	acct'd for	1,196.2	100%
	Total	2,174.0	80%
	acct'd for	2,628.0	97%

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## **Appendix C.**

### **Focus Group Report**

By Christy Nordstrom  
Foodesign, Seattle

On March 9, 1987 in Seattle, Washington, nine foodservice operators, managers, consultants, chefs and purchasers from both the commercial and non-commercial segments of the industry tasted and evaluated the two test market forms of frozen Alaska salmon:

- (A) Skinless, Boneless Fillet
- (B) Formed Salmon Patty.

Because these two segments of the industry look at menu items from a different point of view, the results of the tests are broken into two parts:

#### **Commercial and Noncommercial.**

- |                          |  |
|--------------------------|--|
| 1. Results Unlimited     | Marlen Bell, Consultant to Food and Beverage industry, predominantly full service restaurants.                               |
| 2. The Bon               | Linda Burner, Chef and Food Consultant, two types of restaurants in store chain, one white table and second cafeteria style. |
| 3. Skippers, Inc.        | Carolyn Mullins, Director Product Services, fast food seafood chain  |
| 4. Giorgina's Restaurant | Marlis Korber, owner, one unit specialty restaurant that serves pizza and cold salads  |

#### **II. Noncommercial businesses represented**

- |                                    |   |
|------------------------------------|---|
| 1. Swedish Hospital Medical Center | Barbara Lloyd, R.D.                     |
| 2. Marriott at Weyerhaeuser        | Steven Eason                            |
| 3.                                 | Chef Anneliese Foster, Manager          |
| 4. Park Ridge Care Center          | Lynn Smatsky, Food Service Manager      |
| 5. All Seasons Living Center       | Shirley Broughton, Consultant Dietician |

### **Result from Commercial Sector Questionnaire**

#### **Current and Considered Fish Uses**

Numbers 1 to 4 correspond to Commercial Businesses and people listed on page one.

*Do you now use a frozen salmon product on your menu?*

- 1. Specials
- 2. Yes
- 3. No - removed from menu. Deep fried salmon had low sales with coastal customers.
- 4. No

---

*Do you now use any frozen fish on your menu?*

1. Cod
2. Yes
3. Pollock and cod
4. Shrimp

*Have you considered using the following forms of salmon on your menu?:*

	1.	2.	3.	4.
Fresh	no	yes	no	no
Frozen	yes	yes	yes	yes
Fillets	yes	yes	maybe	no
Steaks	no	yes	maybe	no
Minced	maybe	no	no	yes

#### *Product Evaluations*

Both products were evaluated based on appearance, taste, texture, moisture and overall quality on a scale of 1 to 5, with 1 as outstanding and 5 unacceptable.

- 1 = Outstanding
- 2 = Acceptable
- 3 = Moderately acceptable
- 4 = Needs improvement
- 5 = Unacceptable

The average scores and comments are listed below:

*(A) Raw, skinless, boneless fillets*

Appearance score:	Moderately acceptable
Moisture:	Acceptable
Overall Quality:	Moderately acceptable

#### Comments:

1. Dark spots not appealing; buyer resistance because "manipulated product": based on price and sell as well as surimi in retail.
2. Brown spots degrade appearance
3. All dark trim (belly flap?) should be removed - it will affect your finished flavor (on storage) as well as color. I think A smells stronger than B and it could be due to this since products are 8 months old.
4. Nice appearance. Raw flaky fish. Dark spots strange at first, but they cook up nicely.

*(A) Baked, Skinless, Boneless Fillets*

Appearance:	Needs improvement
Taste:	Acceptable
Texture:	Moderately Acceptable
Moisture:	Moderately acceptable
Overall Quality:	Moderately acceptable

---

Comments:

1. Would only recommend service with a covering/coating such as sauced entirely, breaded OR in chunks, as an ingredient.
2. Dark, brown spotted degrade appearance; dry; . appearance need work.
3. Dark splotches should be removed; dry. I'm not sure this product achieves any benefit for you. Probably would be best to do fillets and then mince out of trim for use as an ingredient as well as foodservice pieces.

(B) *Raw Formed Salmon Patty*

Appearance:	Moderately acceptable
Moisture:	Acceptable
Overall quality:	Moderately acceptable

Comments:

1. Looks too much like spam.
4. Depends on use - for table service it looks pulverized and not acceptable.

(B) *Pan Fried Formed Salmon Patty*

Appearance:	Needs improvement to moderately acceptable
Taste:	Moderately acceptable to acceptable
Texture:	Needs improvement
Moisture:	Needs improvement
Overall quality:	Needs improvement to moderately acceptable

Comments:

1. Looks like spam/processed as opposed to the true ingredient. Not as much flavor as fillet, but not undesirable. Relatively mild, mealy, dry.
2. Mealy. Dry, some moisture.
3. Clean. No off flavors, slightly sweet. Texture slightly spongy. Dry. Needs some improvement.

(B) *Deep Fried Formed Patty* which was battered and breaded with Griffiths Laboratory product.

Appearance:	Moderately acceptable
Taste:	Acceptable
Texture:	Needs improvement
Moisture:	Needs improvement
Overall quality:	Needs improvement

Comments:

1. Mealy, dry but not as dry as pan fried. I feel the formed patty is not acceptable for full service restaurants primarily due to texture. I also question its application to most fast food also. But see a potential application in retirement and health care facilities.
2. Batter and crumb coating too hard. Entire salmon dry. The cooking method of lightly breading and deep frying seem very appropriate for this product. The outer crust should be lighter and cooked for less amount of time. I think this would be a good menu item especially with a dipping sauce. It could even be cut into strips or chunks. Flavor is very good.

3. Color a bit dark. Batter and breading has a nice flavor. Slightly dry salmon. Batter/breading adherence could be better. I assume you battered and breaded frozen pieces - might need a little pre-dust for this.
4. Sweet in flavor. Breading compliments well. Frying keeps moisture in very well.

(A) *Raw Costs*

What would you pay ?

		(A) Fillets	(B) Patty
1.		\$4.00/lb.	\$3.00/lb.
2.	4 oz.:	2.80/lb.	2.40/lb.
	6 oz.:	2.72/lb.	2.10/lb.
	8 oz.:	2.72/lb.	2.40/lb.
3.	4 oz.:	2.40/lb.	1.60/lb.
	6 oz.:	2.10/lb.	1.60/lb.
	8 oz.:	2.00/lb.	1.60/lb.

Tasters saw this product being sold to them in their foodservice operation at an average of \$2.67 per pound for the fillet. And an average of \$2.10 per pound for the formed patty. They would expect to pay \$0.89 for a 4 ounce serving of skinless, boneless. They would expect to pay \$0.70 for a 4 ounce service of formed patty.

B. *Product Use*

Do you see (A) Skinless, Boneless or (B) Formed Patty as center of the plate?

1. No
2. Yes
3. Probably, although in much smaller strips or pieces because we would (Skipper's) need to cook from frozen in less than 3 minutes. This shape may be a deterrent to Skipper's because it's not a finger food.

Do you see (A) or (B) used as an ingredient in a recipe / recipe ideas.

1. (A) - Yes for fillet.  
(B) - Not many applications for, croquette ingredient.
2. (A) - Center of the plate pan-fried or baked and served with a ribbon of sauce over; needs garnish.  
(B) - In pasta or other salads
3. Possibly; salmon cakes (a la crab cakes); salmon stuffing for rolled fish (see fishery products seafood elites); or stuffed flounder or stuffed shrimp.

C. *Product Packaging*

How would you prefer to purchase the product?

1. Maximum of 12 fillets per vac-pack. Not packed bulk. Vac pack carton should contain 100 to 150 fillets.
2. Vak-packed portions

3. Either vak-packed or portions in a carton, IF THEY CAN BE EASILY SEPARATED. Perhaps separated with paper liners.

**D. How can these products be improved?**

2. Appearance: brown spots removed. Texture somewhat grainy. Could be cooked less? These products seem good if cooked properly and used properly – for healthcare, cafeteria dining rooms, fast food, etc. For higher end or middle of the road foodservice operations, it doesn't seem acceptable. as they would just as use fresh or frozen silver as it is comparable in price.
3. These kind of manufacturing processes are being used for pollock (especially minced). I think you need to work on shape for A also, although I think you'd be better off with a fragile fillet than a steak. Talk with Margie Einstein (a Seattle based Food Consultant, works with food companies on new product development) about Pederson's (producer of Washington grown chicken) minced chicken she worked on. Would give some ideas on potential for this product as an ingredient.

**Results from Non-Commercial Segment Questionnaire**

Current and Considered Fish Uses

Numbers 1 to 5 correspond to Non Commercial Businesses and people listed on page one.

*Do you now use a frozen salmon product on your menu?*

1. Yes, fresh salmon and halibut steaks on the patient menu.
2. Yes.
3. Yes
4. No
5. No, canned.

*Do you now use any frozen fish on your menu?*

1. Yes: Boneless cod fillets, shrimp, breaded fish sticks, cod squares, (fishwich), and batter dipped cod.
2. Yes.
3. Yes.
4. Yes: Cod, pollock, snapper, sole
5. Yes.

*Have you considered using the following forms of salmon on your menu?:*

	*1.	*2.	3.	4.
Fresh	Yes	Yes	Yes	No
Frozen	yes	yes	yes	Yes
Fillets	No	yes	Yes	No
Steaks	No	yes	Yes	No
Minced	No	Yes, bulk	No	

- \*1. Now uses fresh salmon steaks on their patient menu. In cafeteria, patrons do not wish to pay the price. Have not considered minced because before now only consideration was minced canned. Would not consider this product because of the bones and the cartilage contained.
- \*2. Use fresh in their executive dining room. Frozen in their foodservice operation for employees.

---

### *Product Evaluations*

Both products were evaluated based on appearance, taste, texture, moisture and overall quality on a scale with 1 as outstanding and 5 unacceptable.

- 1 = Outstanding
- 2 = Acceptable
- 3 = Moderately acceptable
- 4 = Needs improvement
- 5 = Unacceptable

The average scores and comments are listed below:

(A) *Raw, Skinless, Boneless Fillets*

Appearance score:	Moderately acceptable
Moisture:	Moderately acceptable to acceptable
Overall Quality:	Acceptable

Comments:

- 4. Looks nice. Although not traditional fillet form, would be acceptable for institutions.
- 5. Not "natural form". Pre-formed cuts have negative recutation. Large size not appropriate for nursing home setting.

(A) *Baked Skinless Boneless Fillets*

Appearance:	Moderately acceptable
Taste:	Acceptable
Texture:	Acceptable
Moisture:	Moderately acceptable
Overall quality:	Moderately acceptable

Comments:

- 1. Looks dry, seemed drier overall.
- 4. Dark pockets detract. Tastes fine. Easier to chew than pre-formed. Would benefit from a sauce. For an institution it is nice. Would be a worthwhile product.
- 5. Need smaller portion: 3 ounce for nursing home. Not as flavorful. Appearance detracted.

(B) *Raw Formed Salmon Patty*

Appearance:	Moderately acceptable
Moisture:	Moderately acceptable
Overall quality:	Moderately acceptable

Comments:

- 4. Too thick; want thinner slice. Less rectangular shape would help it. Looks moist; keeps shape when raw.

- Patty appears too large.

(B) *Pan Fried Formed Salmon Patty*

Appearance:	Moderately acceptable
Taste:	Acceptable
Texture:	Moderately acceptable
Moisture:	Moderately acceptable
Overall Quality:	Acceptable

Comments:

- Very light color. Washed out, not uniform. Good taste! More difficult to cut than to chew, but might be a problem with denture, etc. Seems to hold moisture in pockets. Not too bad, but pre-formed patties, we have found in the nursing home industry, are often disliked based only on the fact that they are formed.
- Large size. A little dry.

(B) *Deep Fried Formed Patty*, which was battered and breaded with Griffiths Laboratory product.

Appearance:	Outstanding to acceptable
Taste:	Moderately acceptable
Texture:	Moderately acceptable
Moisture:	Moderately acceptable
Overall quality:	Moderately acceptable

Comments:

- Perhaps a smaller, rounded patty would work well for a "fishwich" type entree.
- Seems dry.
- Looks nice. Batter very salty. Has a negative-fried taste. Moisture is good. Really did not like the batter, but had lost some of the strong salmon flavor. Texture improved with deep frying. Possibly pan-fried too long? Pan-fried seemed dryer.

A. *Raw costs.*

What would you pay?		(A) Fillets	(B) Patty
1.		\$1.60/lb.	
2.	4 oz.	--	--
	6 oz.:	3.99/lb.	--
	8 oz.:	3.99/lb.	--
3.	4 oz.:	--	--
	6 oz.	--	--
	8 oz.:	2.99/lb.	--
4.	4 oz.:	0.75/lb.	0.36/lb.
	6 oz.:	1.50/lb.	0.80/lb.
	8 oz.:	1.70/lb.	1.00/lb.
5.	4 oz.	1.80/lb	1.80/lb.

Nursing home would only use a 4 ounce serving.

---

*B. Product Use*

Do you see (A) Skinless, Boneless or (B) Formed Patty as center of the plate?

2. Could be used only if heavily sauced
3. Could be dressed up with various toppings or sauces
4. Possibly, if covered with sauce
5. If smaller or reshaped

Do you see (A) or (B) used as an ingredient in a recipe and recipe ideas.

1. If (A) Skinless, Boneless fillets were packed in chubs
4. Would work nicely in salads, soup, casseroles and mixes
5. Yes, in chowders and salads

*C. Product Packaging*

How would you prefer to purchase the product?

1. Prefer portions packed in a carton
2. Portions packed individually
3. Individually packed / 24 per pack
4. Large cartons

*D. How can these products be improved?*

1. If I were to use the fillet as an ingredient, I would want a larger size to flake.
2. Add more moisture to product by retaining more natural oil.
4. Possibly a different cut: rectangular and thinner.
5. Overall interesting product. Advantage it is with out bones. Other concerns: variety size portion and cost.

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To: Eric Eckholm  
From: Christy Nordstrom  
Date: October 8, 1986  
Subject: Cooking Directions for Fillets

I. FILLETS

A. Oven Baking

1. Preheat oven to 375 degrees F.
2. Baking time is determined by thickness.
3. Measure thickness of salmon.
4. Place salmon on oiled baking sheet
5. Bake 10-12 minutes per inch of thickness.
6. Test for doneness. Fish is done when it flakes with a fork.

B. Broiling

1. Preheat broiler.
2. Broiling time is determined by thickness  
Measure thickness of salmon.
3. Place salmon on oiled baking sheet.
4. Broil 10 to 12 minutes per inch of thickness.
5. Turn salmon halfway through cooking time.  
Test for doneness: Fish is done when it flakes with a fork.

C. Grilling

1. Prepare charcoal wood or gas grill.
2. Grilling time is determined by thickness.  
Measure thickness of salmon at thickest part.
3. Place salmon on grill 4 to 6 inches above heat.
4. Grill 10 to 12 minutes per inch of thickness.  
Turn salmon halfway through cooking time.
5. Test for doneness. Flakes when done.

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### Recipes for Fillets

Recipe 1 for Fillets:

#### PARSLEY HERB SAUCE FOR SALMON FILLETS

Yield: 1-1/2 Quarts

Portion: 1 ounce (2 tablespoons)

Servings: 48

#### INGREDIENTS

#### MEASURE

#### METHOD

Garlic, minced

2 cloves

Sauté garlic and onions in oil, 3 to 4 minutes over low heat. Add parsley and tarragon, cook 1 minute. Stir in wine, vinegar and stock, bring to a boil. Stir until sauce thickens

Green onions,  
chopped

6

Vegetable oil

1/4 cup

Parsley, chopped

2 quarts

Dried tarragon or dill

1 teaspoon

Dry white wine

2/3 cup

White wine vinegar

2/3 cup

Fish or chicken stock

1/4 cup

Lemon Juice

1/4 cup

Puree sauce with machine running, add lemon juice, butter, salt and pepper.

Melted butter

6 sticks/ 1 1/2  
lb.

Salt

1/2 teaspoon

Pepper

1/4 teaspoon

Serve with salmon fillets.

Recipe 2 for Fillets: LEMON-LIME CHIVE BUTTER

Yield: 1 quart

Portion: 1/2 oz. (1 tablespoon)

Servings: 48

#### INGREDIENTS

#### MEASURE

#### METHOD

Butter, softened

2 pounds

Combine all ingredients.

Lime juice

1/2 cup

To Serve: With pastry bag swirl 1/2 ounce portions into serving cups.

Chives chopped

1/4 cup

Grated lemon rind

2 tablespoons

Chill before serving.

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### Two Boil-In-Bag Recipes for Sauce

#### Recipe 1: BOIL-IN-BAG LEMON BUTTER SAUCE

INGREDIENTS	MEASURE	METHOD
Salmon fillets	4 ounces	Place all ingredients in one boil in bag Seal. Freeze.
Butter or margarine	1/4 teaspoon	Cook as directed.
Lemon juice	1/4 teaspoon	
Dried chives, dill or parsley	1/4 teaspoon	

#### Recipe 2 for 50 Fillets: PARSLEY HERB SAUCE FOR SALMON FILLETS

INGREDIENTS	MEASURE	METHOD
Garlic, minced	2 cloves	Sauté garlic and onion in butter, 3 minutes
Green onions	6	
Butter	4 sticks, 1 lb.	
Dried parsley	2 cups	Add parsley, tarragon, wine, vinegar, lemon juice, salt and pepper.
Dried tarragon or dill weed	2 teaspoons	
White wine	1/2 cup	Simmer until thickened
White wine vinegar	1/2 cup	Add 1 1/2 teaspoons to each salmon fillet before sealing in boil-in-bag
Lemon juice		
Salt	1/2 teaspoon	Seal. Freeze.
Pepper	1/4 teaspoon	Cook as directed.

### Deep Fried Cooking Instructions

#### BATTERED AND BREADED SALMON OR STEAK:

Fry: 4-5 minutes	Yield: 50	
Deep fat fryer:	350° F.	Portion: One 4 ounce patty or steak
INGREDIENTS	MEASURE	METHOD
Salmon, frozen	50 patties or steaks (12.5 lb.)	Fry fish in deep fat fryer
		More time is needed to fry more pieces at the same time.

## APPENDIX D

### 86 QC DATA

LOT C23286

Production day 8/20/86

Comments: Fish brought in from west Prince William Sound, estimated age 36 hr. minimum. Some fish soft, others bruised, overall quality fair for freezer grade. This lot is 15% mince added to fillets with 0.5% salt and mixed for 2 minutes in the ribbon mixer. This was the very first product produced. The bone count is representative of the fillets produced during this period.

Lot Size:	Combination	7.5	48	553.0
LOT GRADE: C				
Sample	1		2	3
Blemishes:				
Bones:	37		27	30
Bruises				
Fat				
Skin			2	4
Misc.				
Totals	63		71	66
Thaw Drip	2.15		3.5	
Cook Drip				

#### BACTERIOLOGICAL SUMMARY:

TPC 35 Deg F.      14000  
nt

25 Deg F.

Total Staph. aureus (MPN/g) 0.9  
Identified Staph

Total Coliforms  
Fecal Coliforms

460  
lt0.3

#### Dilution

Aeromonas hydrophilia  
Hafnia alvei  
Citrobacter freundii

E. Coli

Proteus inconstans

Pro. mirabilis  
Pro. vulgaris

LOT B23286

Comments: Fish brought in from west Prince William Sound, estimated age 36 hr. minimum. Some fish soft, others bruised, overall quality fair for freezer grade. The first part of this mince, the 7.5 " product, contains bellys from the 184 line. Oil content can be expected to be much higher than for the 6.5" lot that followed. The break point between belly in and belly out product occurs somewhere in the 6.5" lot.

Lot Size:	Bibun Mince	7.5		58	668.0
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LOT GRADE: A

Sample	1	2	3
Blemishes:			
Bones:	0	0	22
Bruises			
Fat			
Skin	4		
Misc.		5	
Totals	96	95	78
Thaw Drip	10.8	12.7	
Cook Drip	9.4(?)		

# BACTERIOLOGICAL SUMMARY:

TPC 35 Deg F.	BC	17,000	25 Deg F.	130,000	
	BC	18,000			
Total Staph. aureus (MPN/g)	0.9		Total Coliforms	240	
Biochem	0.4		24	460	It 0.3 Fecal
Coliforms	0.9				
Biochem Identified Staph					Fecal Coli
0.4					
	Dilution				0.3
			Aeromonas hydrophilia		
			Citrobacter freundii		
			Klebsiella aerogenes		
vulgaris					Proteus
			Hafnia alvei		

LOT B23286

Lot Size: Bibun Mince 6.5 141 1170

Comments: Fish brought in from west Prince William Sound, estimated age 36 hr. minimum. Some fish soft, others bruised, overall quality fair for freezer grade. This lot contains approximately half product with a substantial amount of oil in it as bellys from the 184 line are added in. The remainder contains only fillet meat.

LOT GRADE: A

Sample 1 2 3

Blemishes:

Bones: 6

Bruises

Fat

Skin

Misc.

Totals 94

Thaw Drip

Cook Drip

BACTERIOLOGICAL SUMMARY:

TPC 35 Deg F. BC 1,400 25  
Deg F. 130,000

Total Staph. aureus (MPN/g) 110.0 Total

Coliforms 460

Biochem 460 1t 0.3

Coliforms 23.0 Fecal

9.3  
Biochem Identified Staph Fecal Coli

2.3  
Dilution

*Yersinia enterocolitica*

*Aeromonas hydrophilia*

*Aero. salmonicida*

*Citrobacter* sp.

*Klebsiella pneumoniae*

*Proteus vulgaris*

LOT F23286

Lot Size:	Fillets	6.5	52	434
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Comments: Fish brought in from west Prince William Sound, estimated age 36 hr. minimum. Some fish soft, others bruised, overall quality fair for freezer grade. The 6.5" fillet product was the first fillets produced, and the bone content is high. The fish moved through the line fairly quickly, however, and TPC bact. counts are low. There are however high coliform counts.

LOT GRADE: C

Sample	1	2	3
Blemishes:			
Bones:	44	33	
Bruises			
Fat			
Skin			
Misc.			
Totals	56	67	
Thaw Drip	8.4	8.9	
Cook Drip			

BACTERIOLOGICAL SUMMARY:

TPC 35 Deg F. BC	39,000	25 Deg F. 61,000
Total Staph. aureus (MPN/g) 0.3		Total Coliforms
460		
Biochem      lt 0.3		1100
0.9		Fecal Coliforms
Biochem Identified Staph		Fecal Coli lt0.3
Dilution		
	Aeromonas hydrophilia	
	Hafnia alvei	
	Klebsiella sp.	
		Proteus inconstans

LOT F23286

Lot Size: Fillets 7.5 155 1782

Comments: Fish brought in from west Prince William Sound, estimated age 36 hr. minimum. Some fish soft, others bruised, overall quality fair for freezer grade. The bone count did not improve much from the previous 6.5" lot. The bact counts remain fairly consistent, but the total coliforms drop a little.

LOT GRADE: C

Sample	1	2	3
Blemishes:			
Bones:	38	35	
Bruises			
Fat			
Skin	2	2	
Misc.			
Totals	60	63	
Thaw Drip	6.6	4.9	
Cook Drip	9.4,7.0		

BACTERIOLOGICAL SUMMARY:

TPC 35 Deg F.	BC 31,000	25 Deg F.
48,000		

Total Staph. aureus (MPN/g) 0.4		Total
Coliforms 23		
Biochem lt 0.3	460	
	Fecal Coliforms	0.9
Biochem Identified Staph	Fecal Coli	0.9
Dilution		
	Aeromonas hydrophilia	
	Klebsiella sp.	
	Erwinia sp.	
	Morganella morganii	
	Proteus inconstans	

LOT F23686

Lot Size:	Fillets	6.5	176	1457
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Comments: Fish came from Port San Juan Hatchery, estimated age 24 hr. Generally good color, significant number of bruises. Pale fillets graded out and minced. Workmanship better than first day in beginning, though line changes led to major pin bone problems in afternoon. Most showed up on 7.5" lot. The first fillet production of the second day shows much better bone counts, and bacterial results similar to the first day. However, staph and fecal counts appear to come up some, perhaps due to increased handling.

LOT GRADE: A

Sample	1	2	3
Blemishes:			
Bones:	6		
Bruises	2	16	8
Fat			
Skin		2	
Misc.			
Totals	98	82	92
Thaw Drip	8.4		

Cook Drip

#### BACTERIOLOGICAL SUMMARY:

TPC 35 Deg F.	BC	1,000	25
Deg F. 41,000			
Total Staph. aureus (MPN/g)		9.3	Total
Coliforms 1100			
Biochem 0.4			
460			
Coliforms 2.3			Fecal
Biochem Identified Staph			Fecal Coli
1t0.3			
Dilution			
Aeromonas hydrophilia			
Citrobacter freundii			
Klebsiella aerogenes			
Proteus vulgaris			

LOT F23686

Lot Size: Fillets 7.5 226 2436

Comments: Fish came from Port San Juan Hatchery, estimated age 24 hr. Generally good color, significant number of bruises. Pale fillets graded out and minced. Workmanship better than first day in beginning, though line changes led to major pin bone problems in afternoon. Most showed up on 7.5" lot. The bone count goes up along with the bacterial counts in this lot, indicating the slower throughput due to redoing rejects and diminished performance of the crew as the end drew near.

LOT GRADE: B

Sample	1	2	3
Blemishes:			
Bones:	8	6	23
Bruises	2		
Fat			
Skin	2		
Misc.		6	
Totals	88	88	79
Thaw Drip	9.6		

Cook Drip

BACTERIOLOGICAL SUMMARY:

TPC 35 Deg F.	BC	21,000
25 Deg F.	100,000	
Total Staph. aureus (MPN/g)		2.3 Total
Coliforms 460		
Biochem		lt 0.3
110		
		Fecal
Coliforms 4.3		
Biochem Identified Staph		Fecal Coli
lt 0.3		
Dilution		
Aeromonas hydrophilia		
Aeromonas salmonicida		
Citrobacter freundii		
Enterobacter sp.		
Hafnia alvei		

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Klebsiella sp.  
Proteus vulgaris  
Pro. inconstans  
Pro. rettgeri

Lot Size:	Beehive Mince	7.5	83	962
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The beehive mince was produced from sorted waste streams and topcuts, with the majority being topcuts. The product is noticeably drier than the Bibun product, and had good color and was very clean in appearance. The relatively high fecal and staph counts probably reflect the extra handling, though the TPC's don't reflect the slower processing and difficulty in cleaning the machine that might be expected.

LOT GRADE: A

BACTERIOLOGICAL SUMMARY:

TPC 35 Deg F.	BC	6,300	25
Deg F.	160,000		
Total Staph. aureus (MPN/g)	0.4		Total
Coliforms	240		
Biochem	9.3		
43			
			Fecal
Coliforms	23.0		

---

Biochem Identified Staph

2.3

Fecal Coli

Dilution

*Aeromonas hydrophilia*

*Citrobacter freundii*

*Klebsiella aerogenes*

*Proteus vulgaris*

LOT B23686

Lot Size: Bibun Mince 7.5 278 3339

Comments: This Bibun mince was produced from sorted waste streams and topcuts, with the majority being topcuts.

LOT GRADE: A

Sample 1 2 3

Blemishes:

Bones: 0

Bruises

Fat

Skin

Misc.

Totals 100

Thaw Drip 8.9

Cook Drip

BACTERIOLOGICAL SUMMARY:

TPC 35 Deg F. BC 25  
Deg F. 100,000

Total Staph. aureus (MPN/g) 2.3 Total  
Coliforms 460  
Biochem Fecal  
Coliforms 4.3

Biochem Identified Staph

Dilution

Aerococcus viridians Enterobacter

clocae Hafnia alvei

S. hominis

S. capitus

S. intermdius

S. sp.

Erwinia sp.

---

LOT M23686

Lot Size:	Mixed mince and fillets from changeovers		
	7.5	8	93
	6.5	19	158

Comments: During caseup this lot was mixed in with either the B23686 Bibun lot or the F23686 fillet lot and was shipped as such to Seafreeze.

LOT GRADE:

Sample	1	2	3
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Blemishes:

Bones:

Bruises

Fat

Skin

Misc.

Totals

Thaw Drip

Cook Drip

# LOT SFAFIL

Lot Size:	Fillets	Production date 8/15/86
	7.5	630
	6.5	294

Comments: Fish were caught 8/12/86 at Cook Inlet setnet site, iced in 600 lb totes and trucked in. Headed and gutted 8/13, filleted 8/14 and 8/15. Fish were generally large, averaging 4.5-5.0 lb, good meat color, some bruising, generally firm.

# LOT SFAcom

Lot Size:	15% Mince in fillets	Production
date 8/15/86		
	6.5	269

Comments: Fish were caught 8/12/86 at Cook Inlet setnet site, iced in 600 lb totes and trucked in. Headed and gutted 8/13, filleted 8/14 and 8/15. Fish were generally large, averaging 4.5-5.0 lb, good meat color, some bruising, generally firm. Mince was mixed in using meat mixer which tore up the fillets badly. Hard to distinguish mince from meat in product, but texture suffered.

# LOT GRADE: A

Sample	1	2	3
		Mince	
Blemishes:			
Bones:	6	16	
Bruises			
Fat			
Skin	2		
Misc.			
Totals	92	84	

Thaw Drip

Cook Drip

BACTERIOLOGICAL SUMMARY: all tests by Biochem

TPC 35 Deg F.	BC	3,900	
Mince	17,000		
Total Staph. aureus (MPN/g)	4.3	Total Coliforms	4.3
Mince	4.3		4.3
	Fecal Coliforms	0.3	

# BIOCHEM AND FITC MICROBIOLOGICAL TESTS

## Total and Fecal Coliforms

Lot No.	Total C	Fecal C	Hetero	Staph Coliform Sp.
C23286	7.5	460	0.9	0.3 max
43	0.4			Enterobacter cloacae Citrobacter freundii E. coli*
B23286	6.5	460	23.0	110.0
460	2.3		4.3	

---

**BIOCHEM  
ENVIRONMENTAL SERVICES, INC.**

January 22, 1986

Mr. Paul Peyton  
Project Manager  
Offc. Commercial Fisheries Development  
DEPT. COMMERCE & ECONOMIC DEVELOPMENT  
STATE OF ALASKA  
Box D  
Juneau, AK 99811

Dear Mr. Peyton:

Enclosed is our Final Report on microbiology of salmon fillets. This Report supersedes the Interim Data submitted to you on January 14, 1987.

Generally, it appears that the processes that you have instituted or supervised produce a fine product. The Final Report's Summary provides a small amount of our interpretations for you, which will tend to support the former statement.

We have also enclosed the current invoicing for the project. Since we have not received a copy of the most recent contract, we are somewhat uncertain if the Not to Exceed figure is adequate for the current billing. Please notify us if there will be complications.

Again, if we can be of further assistance in interpreting results or analyzing samples, do not hesitate to call.

Sincerely,  
BioChem Environmental

Services, Inc.

Gregor J. Ma, MSPH  
Laboratory Director

1432 ELLIOTT AVE. WEST SEATTLE, WASHINGTON 98119  
(206) 281-9099

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**BIOCHEM  
ENVIRONMENTAL SERVICES, INC.**

January 20, 1987

Alaska Fish Samples  
Department of Commerce  
State of Alaska  
FINAL REPORT

Early in November, 1986, BIOCHEM ENVIRONMENTAL SERVICES, INC. was requested by Mr. Paul Peyton of the DEPARTMENT OF COMMERCE, STATE OF ALASKA, to analyze processed Salmon fillets for specific microbiological parameters. These included sanitary bacteriology (Total Coliform, Fecal Coliform, Heterotrophic Plate Count), quantitative Staphylococcus aureus, and human enteric pathogen recovery. Additionally, we were requested to identify the organisms recoverable from the coliform procedures on these samples.

Three lots of frozen salmon fillets, each subdivided into three samples were brought to laboratory on November 11, 1986. Each subdivision was assigned a BIOCHEM sample number (nine samples total), and was processed for all parameters described above.

Eleven (11) samples had been submitted and processed under an earlier contract (October 2, 1986). These samples, held frozen since receipt, were to be processed for the coliform population identification only.

PROCESSING PROCEDURES

All sample preparation procedures were performed aseptically in a laminar flow hood by a gowned and gloved microbiologist.

Exterior surfaces of all samples were removed by the use of sterile knife blades. Core sections were collected from each frozen sample by the use of sterilized cork borers.

Ten (10) grams of homogenized sample were inoculated into each of two enteric pathogen enrichments: Selenite broth and GN broth.

Selenite broth enrichments were incubated at 35C for 15-18 hours, then loopfuls were transferred to primary selective agar plates: Hektoen, Salmonella-Shigella, and MacConkey. These agar plates were incubated at 35C for 24 hours and suspect colonies picked for identification.

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GN broth enrichments were incubated at 4C for 14-21 days, then streaked onto Yersinia selective and differential media: YM agar and MacConkey-Tween agar. These agar plates were incubated at 24C for 60 hours and suspect colonies picked for identification.

Twenty-five (25) grams of homogenized sample were added to 225 ml of sterile buffered water and mixed on an industrial Waring blender at high speed for 90 seconds. A dilution series in buffered water was prepared. These dilutions were used as inocula for the Total Coliform, Fecal Coliform, Heterotrophic Plate Count, and Staph. aureus tests as described in the Bacteriological Analytical Manual published by U.S. Food and Drug Administration.

Isolation of organisms from the coliform procedures was performed by streaking turbid confirmatory media in the Total Coliform and Fecal Coliform procedures onto Eosin Methylene Blue agar plates and incubating at 35C for 24 hours. Representative colonies were picked for identification.

Identifications were made by conventional tubed biochemical reactions. Procedures are described in Cowan's Manual for the Identification of Medical Bacteria, and in Identification Methods for Microbiologists, edited by Skinner and Lovelock. Other manuals and identification keys consulted included Bergey's Manual of Systematic Bacteriology, vols 1 and 2, and Edwards' and Ewing's Identification of Enterobacteriaceae.

## RESULTS

Quantitative values of sanitary bacteriology of Alaska salmon fillets submitted for testing on November 11, 1986 are presented in Table 1. Results of Staph. aureus quantitation and pathogenic enteric bacteriology are tabulated in Table 2.

Non-pathogens identified from the special procedures are listed in Table 3.

Organisms isolated and identified from the Total and Fecal Coliform procedures are presented in Table 4 (Nov. 11 samples) and Table 5 (October 2 samples).

## SUMMARY

Quantitative procedures show that Total Coliforms are present in the samples at a level approaching, and occasionally exceeding 100 per gram. At the same time, the more specific Fecal Coliform procedure provides evidence of a product relatively free of fecally-associated bacterial contamination. The low Staph. aureus counts, with one exception, are also suggestive of a high quality product, in the one instance where Staph. aureus count exceeded MPN 20/gram, two other samples from the same lot had less than MPN 1/gram.

There were, rarely, some Streptococci present, but there was no commission or funding to warrant their isolation and identification. This indicator group may warrant further attention in future.

No human enteric pathogens were found in any of the nine samples. The isolates recovered in the pathogenic enrichment procedures were largely those expected to be recovered from the coliform procedures with a few exceptions--e.g., *Alteromonas*, *Pseudomonas*, *Pleisiomonas*.

The organisms identified from the coliform procedures as well as those in the enteric enrichments, have at minimum, two possible origins. *Citrobacter*, *Escherichia* and possibly *Hafnia alvei* and *Serratia liquifaciens* are suggestive of human or other mammalian sources. The other organisms, particularly *Aeromonas*, *Pseudomonas*, *Pleisiomonas*, may have originated from the fish themselves (especially from the gills and/or gastrointestinal tract.)

As expected, there were few instances where *Klebsiella* spp. were recovered, and then only in the group of samples submitted October 2. It is not unusual for these to appear in the fecal coliform procedure. It is notable that the coliform counts from the October 2 group are lower at this sampling than the previous sampling (Report of Nov. 19, 1986).

If there are any questions regarding our report, or we can provide any further assistance in interpretation or recommendations, please do not hesitate to call.

Respectfully submitted,

BIOCHEM ENVIRONMENTAL SERVICES, INC.

Theodore F. Wetzler, PhD, MPH  
Research Director and  
Chief Executive Officer

**BIOCHEM**  
**ENVIRONMENTAL SERVICES, INC.**

TABLE I  
SANITARY BACTERIOLOGY OF  
ALASKA FISH SAMPLES  
(Nov. 11, 1986)

Alaska ID	BioChem ID	(MPN per gram)		(cfu per gm)
		Total Colif.	Fecal Colif.	Hetero. Count
B23686	C0730	150	<0.3	7,600
7.5"	C0754	93	0.4	8,300
	C0755	23	<0.3	12,100
F23686	C0731	93	0.4	19,000
6.5"	C0756	75	<0.3	10,000
	C0757	93	0.4	15,000
F23868	C0732	430	0.4	22,000
7.5"	C0758	43	0.4	8,5000
	C0759	93	<0.3	16,000

" = inches

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TABLE 2  
SPECIAL BACTERIOLOGY OF  
ALASKA FISH SAMPLES

(Nov. 11 , 1986)

Alaska ID	BioChem ID	<u>Staph. aureus</u> MPN / gm	Pathogenic Bacteriology*
B23686 7.5"	C0730	<0.3	No Salmonella; No Yersinia
	C0754	<0.3	No Salmonella; No Yersinia
	C0755	<0.3	No Salmonella; No Yersinia
F23686 6.5"	C0731	0.7	No Salmonella; No Yersinia
	C0756	0.4	No Salmonella; No Yersinia
	C0757	<0.3	No Salmonella; No Yersinia
F23686 7.5"	C0732	24	No Salmonella; No Yersinia
	C0758	0.9	No Salmonella; No Yersinia
	C0759	0.9	No Salmonella; No Yersinia

\*From enteric pathogen enrichment procedures.  
" = inches

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TABLE 3  
ORGANISMS ISOLATED FROM ENTERIC PATHOGEN  
AND Staph. aureus PROCEDURES  
(Alaska Fish Samples of Nov. 11, 1986)

Alaska ID	BioChem ID	Isolates from Enteric Procedures	Isolates from <u>St. aureus</u> MPN Procedure
B23686-7.5	C0730	<u>Aeromonas sp.</u> <u>Alteromonas putrifaciens</u> <u>Citrobacter freundii</u> <u>Enterobacter sp.</u> <u>Enterobacter aerogenes</u> <u>Proteus vulgaris</u>	<u>Aerococcus sp.</u> <u>Proteus vulgaris</u>
	C0754	<u>Citrobacter freundii</u> <u>Enterobacter aerogenes</u> <u>Hafnia alvei</u> <u>Serratia liquifaciens</u> <u>Pseudomonas sp.</u>	<u>Staphylococcus sp.</u> (not <u>St. aureus</u> )
	C0755	<u>Citrobacter freundii</u> <u>Enterobacter aerogenes</u> <u>Enterobacter cloacae</u> <u>Pleisiomonas sp.</u> <u>Pseudomonas sp.</u>	<u>Planococcus sp.</u>
F23686-6.5	C0731	<u>Citrobacter freundii</u> <u>Edwardsiella-like</u> <u>Enterobacter sp.</u> <u>Enterobacter aerogenes</u> <u>Pleisiomonas sp.</u> <u>Proteus vulgaris</u> <u>Pseudomonas sp.</u>	<u>Proteus vulgaris</u> <u>Staphylococcus aureus</u>
	C0756	<u>Alteromonas putrifaciens</u> <u>Aeromonas spp.</u> <u>Edwardsiella sp.</u> <u>Pleisiomonas sp.</u> <u>Pseudomonas sp.</u> <u>Serratia liquifaciens</u>	<u>Proteus vulgaris</u> <u>Staphylococcus aureus</u>
	C0757	<u>Alteromonas putrifaciens</u> <u>Aeromonas sp.</u> <u>Citrobacter freundii</u> <u>Enterobacter aerogenes</u> <u>Pleisiomonas sp.</u> <u>Pseudomonas sp.</u> <u>Serratia liquifaciens</u>	<u>Proteus vulgaris</u>

TABLE 3 (Continued)  
ORGANISMS ISOLATED FROM ENTERIC PATHOGEN  
AND Staph. aureus PROCEDURES

(Alaska Fish Samples of Nov. 11, 1986)

Alaska ID	BioChem ID	Isolates from Enteric Procedures	Isolates from <u>St. aureus</u> MPN Procedure
F23686-7.5	C0732	<u>Alteromonas putrifaciens</u> <u>Citrobacter freundii</u> Edwardsiella sp. Erwinia sp. Pleisiomonas sp. <u>Serratia liquifaciens</u>	<u>Proteus vulgaris</u> <u>Staphylococcus aureus</u>
	C0758	<u>Alteromonas putrifaciens</u> <u>Citrobacter freundii</u> - Pleisiomonas sp. Psuedomonas sp. <u>Serratia liquifaciens</u>	<u>Proteus vulgaris</u> <u>Staphylococcus aureus</u>
	C0759	<u>Alteromonas putrifaciens</u> Enterobacter aerogenes Pleisiomonas sp. <u>Proteus vulgaris</u> <u>Serratia liquifaciens</u>	<u>Proteus vulgaris</u> <u>Staphylococcus aureus</u>

TABLE 4  
ORGANISMS ISOLATED FROM COLIFORM PROCEDURES  
PERFORMED ON ALASKA FISH SAMPLES  
(Submitted Nov. 11, 1986)

Alaska ID	BioChem ID	Total Coliform (MPN/gm)	Organisms from TC Procedure	Fecal Dolliform (MPN/gm)	Organisms from FC Procedure
B23686-7.5*	C7030	150	Citrobacter diversus Citrobacter freundii Enterobacter sp. Enterobacter aerogenes Serratia liquifaciens	<0.3	None
	C0754	93	Enterobacter cloacae Serratia liquifaciens	0.4	Escherichia coli
	C0755	23	Citrobacter freundii	<0.3	None
	C0731	93	Citrobacter freundii Escherichia coli-variant Hafnia alvei Serratia liquifaciens	0.4	Escherichia coli
F23686-6.5*	C0756	75	Citrobacter freundii Enterobacter sp. Enterobacter aerogenes Enterobacter agglomerans	<0.3	None
	C0757	93	Citrobacter freundii Enterobacter cloacae Escherichia coli-variant Hafnia alvei	0.4	Escherichia coli
	C7032	430	Citrobacter freundii Enterobacter aerogenes	0.4	Escherichia coli
	C0758	43	Citrobacter freundii Enterobacter cloacae Escherichia coli Hafnia alvei	0.4	Escherichia coli
F2686-7.5*	C0759	93	Enterobacter sp. Enterobacter cloacae Hafnia alvei Serratia liquifaciens	<0.3	None

TABLE 5  
ORGANISMS ISOLATED FROM COLIFORM PROCEDURES  
PERFORMED ON ALASKA FISH SAMPLES

(Submitted October 2, 1986)

Alaska ID	BioChem ID	Total Coliform (MPN/gm)	Organisms from TC Procedure	Fecal Coliform (MPN/gm)	Organisms from FC Procedure
NPP-C23286 7.5	C0629X	43	Enterobacter cloacae	0.4	Escherichia coli
NPP-H23286 7.5	C0630X	93	Citrobacter freundii		
B-232	C0631X	43	Erwinia sp.	<0.3	None
			Enterobacter aerogenes	<0.3	None
Seafoods 15%	C0632X	0.4	Enterobacter cloacae		
Seafoods B mince	C0633X	0.9	Escherichia coli		
			Citrobacter freundii	<0.3	None
			Enterobacter cloacae	<0.3	None
			Erwinia sp.		
NPP-B23286 6.5	C0634X	9.3	Streptococcus sp.		
			Enterobacter cloacae	0.7	Klebsiella oxytoca
			Hafnia alvei		
			Klebsiella edwardsii		
NPP-B23286 7.5	C0635X	9.3	Klebsiella oxytoca		
			Klebsiella edwardsii	<0.3	None
NPP-F23686 6.5	C0636X	43	Hafnia alvei		
			Citrobacter freundii	<0.3	None
			Erwinia sp.		
			Hafnia alvei		
NPP-23686 7.5	C0637X	23	Klebsiella pneumoniae		
			Citrobacter freundii	<0.3	None
NPP-F23286 6.5	C0638X	24	Hafnia alvei		
			Citrobacter freundii	<0.3	None
			Enterobacter cloacae		
NPP-F23286 7.5	C0639X	24	Serratia liquefaciens		
			Enterobacter aerogenes	<0.3	None
			Serratia liquefaciens		

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## **Appendix E**

As part of this product development project, Harmon Blanch at North Pacific Processors was contracted to prepare a report that would discuss fillet production, how to devise and use a quality control monitoring plan, and to describe the special sanitation measures necessary when processing value-added frozen pink salmon products.

### **Production Education Materials**

by Harmon Blanch

#### **INTRODUCTION**

This manual has been divided into three sections with the intention that each section can and should be used independently.

The first section, "*Fillet Processing*," is an introduction to filleting. It will present the processing techniques necessary to produce fillets from a round fish. Additionally, it includes the National Marine Fisheries Service's grade standards for fish fillets as a point of departure for a facility's own standard.

The second section, "*Statistical Quality Control*," is an introduction to statistics, weight control, and attribute sampling. With the information presented in this section, a quality control or assurance group should be able to establish sampling schemes to identify defects created by workmanship, machinery, or unacceptable incoming raw materials.

The last section is entitled, "*Plant Sanitation*." It presents chemical compounds, their application, and recommendations for a sanitation program. As with the other two sections, it includes a standard, "*The Good Manufacturing Practices*."

#### **FILLET PRODUCTION**

1. Processing Equipment and Limiting Factors
2. Incoming Fish Quality and In-plant Storage
3. Hand Filleting
4. Trimming

#### **STATISTICAL QUALITY CONTROL**

1. Measurements of the Population's Width
2. Measurements of Central Tendency
3. Weight Control and Z Scores
4. AQL, Acceptable Quality Level
5. AQLs and Sampling
6. Operating Characteristics Curve
7. Sampling Plan

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## **SANITATION**

1. Sanitation Overview
2. Policy and Procedure
3. Cleaning and Sanitizing
4. General Information
5. Equipment Cleaning
6. Good Manufacturing Practices

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## FILLET PRODUCTION

### *1. Processing Equipment and Limiting Factors*

The addition of mechanized processing equipment into an effective, but labor intensive, operation is not an easy task. As processors begin filleting, previously efficient methods used to dress fish may be found less effective for new product forms and the rate of production. Equipment costs may necessitate diversifying into other species or product forms. The key to making a smooth transition from manual to mechanized processing is to maintain overall compatibility in the processing steps and to identify any limiting factors.

The single slowest step in the production factor is a limiting factor in a series of processing operations. A process can go only as fast as its slowest step (its limiting factor). Practically any change in a line will shift the rate of production (or the limiting factor) from one area to another. As an example, a change as subtle as one missing worker may not be apparent, but five missing workers make the concept of limiting factors very evident. If careful evaluation indicates that a new piece of equipment will raise the rate of the slowest step to a level that makes its purchase economically profitable, then make the investment. If not, then as the old cliché goes, "If it ain't broke, don't fix it." Because the shifts can be subtle, statistics are the best tool for evaluating limiting factors and the need for additional processing equipment.

The drawback of adding any piece of machinery is that it invariably causes a workmanship defect and generally a reduction in recovery for the on-average fish. Except for very expensive equipment, a unit usually has a fairly narrow "average fish" acceptance band. Anything above or below the band will suffer either in recovery or defects as it is turned into an average fish by the unit. If you can increase productivity sufficiently by adding a piece of equipment without sacrificing the savings to increased manpower needed to rework the finished product, then it is apparent that the item is a good investment.

After each step of the processes has been evaluated and tuned to maximum productivity, a decision can be made on where to start automating. When this point is reached, it is best to have a management meeting to discuss how the modification will affect overall plant procedures. A general meeting should include the heads of production, maintenance, sanitation, and quality control. Each will be required to determine how their areas will be affected. For example, the facility's electrical requirements will increase, as will the water demand. With the increased processing, the waste removal capability may have to be increased. Also, the permitting agencies generally require notification of major changes in processing, products handled, or the physical plant.

If possible, equipment should be leased for a trial period. It is rare that equipment performs in the facility as well as it does in the brochure, and a season should give adequate time to critically evaluate its capability. Because a machine always has quirks, it is best to have the services of an experienced technician included in the lease. The technician can verify that the equipment is running properly and can train in-house staff to operate the unit.

There is one final word of caution regarding equipment. The nature of the fishing industry is to boom and bust on targeted species. Equipment, therefore, should be as versatile as it is practical.

## *2. Incoming Fish Quality and In-plant Storage*

A fish spends its life suspended in water of relatively constant temperature. In this environment, its body weight is supported by water, and it requires little more than the skeletal structure necessary for movement.

The three factors which have the greatest effect on final product quality are bleeding at the time of catch, temperature control, and handling. Most animals are bled at the time of slaughter to preserve quality. Fish which are treated in the same manner are noticeably better, and there is a trend in the premium quality market to bleed them as they are caught.

When fish die, they begin to deteriorate as do all living things. This deterioration will continue at a fairly rapid rate if the temperature isn't reduced, and even freezer temperatures do not wholly halt the process.

The majority of fish delivered to the processing facility are transported in tenders with water-filled refrigerated holds. The practice of using fish ladders and dry pumps at the dock is giving way to wet pumps. Fish are being transferred with wet pumps inside some facilities as well. These measures are all part of an effort to avoid bruising the fish.

All fish delivered to the processing facility should be evaluated for quality by someone familiar with the species. The first check should be done at the dock, and evaluation should continue through each major processing step. The checks should assess the overall quality to assure that fish have not been contaminated by fuel, oil, or other adulterants, and have no signs of decomposition.

A worksheet should be maintained for each delivery and should indicate the species of fish received, where and when they were caught, the fishing vessel, the tender, and how they will be stored in the plant. If any exceptions are noted, there should be ample space provided for comment.

- a. Odor:                   The odor should be characteristic of the species and generally not have an odor stronger than the smell of seaweed.  
As the smell changes to no odor, then to a definite fish or fruit-like odor, its shelf life is decreasing.
- b. Belly cavity:       The tissue in the abdominal cavity should be intact, adhering to the ribs, have a gloss, and no reddening.  
As the fish ages, the belly will take on a pink to red hue and begin to have an off-to-sour odor.
- c. Eyes:                The eyes should be clear and translucent with no indication of reddening. As the fish ages, the eyes will turn opaque and become flat or sunken.
- d. Gills:                The gills should be bright red and have no odor. The loss of redness with changes to brown or yellow and an increase in odor indicate a reduction in quality and shelf-life.

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| e. Skin:        | The skin should be bright and elastic. As the fish ages, the skin will wrinkle more easily and lose its color.<br><br>The tissue should spring back when a finger is pressed against the body.<br><br>Scale loss is not a good indicator of spoilage because scales can be lost during shipping. |
| f. Temperature: | The temperature of the fish should be reduced to the desired temperature as soon as possible after it has been caught. The desired temperature will be dictated by the type of refrigeration methods available on the grounds and whether the roe will be used.                                  |
| g. Comments:    | A place should be included for comments. Such remarks should address processing deviations or exceptions.  |

Seafood has a short shelf life when it is kept above freezing. If the shelf life is expended while the fish awaits processing, the consumer will receive a poor quality product.

If unprocessed fish are going to be stored in the facility, temperature should be monitored regularly, and processing should occur as soon as possible. The holding tanks and totes should be cleaned and sanitized after each use. The fish should be layer-iced with flake ice, and the oldest fish should be processed first.

### 3. HAND FILLETING

A review of facilities which fillet fish would yield as much diversity in technique as would be expected in any other area of processing. The best explanation for this probably is that filleting techniques are a mixture of art and science. For this reason, only a general scheme will be given, leaving a great deal of latitude for individual variation.

Experience is the best instructor and can be gained only with time. To lessen the time spent in the learning curve, it is advisable to obtain the services of at least one experienced filleter to work one on one with each new employee. When the initial learning period ends, recovery studies should become a routine part of the process.

#### *Heading:*

The first step in filleting is partially dressing the fish. If the head is removed, begin by making an angled cut from the top of the head around behind the gill plate or collar, then finish the cut under the throat. I prefer to leave the head attached because it gives better body control and eliminates one additional processing step.

#### *Dressing:*

This is done by inserting a knife in the anal vent and making a cut to the throat, just between the gills. If the roe is to be saved, care must be taken not to cut the skein. Special knives are available with a bead on the tip to prevent breaking the skein. Remove the contents of the abdominal cavity. Make a cut through the membrane along the back-bone and clean the blood line with a spoon and

running water . Once the abdominal cavity has been cleaned, check for reddening of the abdominal wall. The red discoloration is generally referred to as belly burn and is an indicator of freshness. If the abdomen is beginning to darken, it is an indication that the fish has been held at elevated temperatures or has been around too long, or both.

#### *Filleting:*

There are two general methods used to fillet. The first is probably more familiar to sport fishermen, and it may be easier to perform while the fish still has its head on. It produces a nice looking fillet with good recovery, but is time consuming because of the number of cuts.

Using a sharp, thin, semi-flexible blade, make an incision along the top of the back from behind the head to the tail. With a little experience, you can feel the point of the knife touching the vertebrae as it rides along the bones supporting the dorsal fins. The fillet will have a much better appearance if the cut can be made in one continuous stroke. The next step is to roll the fillet away from the body, cutting it free of the ribbons starting at the head and working towards to tail.

The second method is to cut the fish in half from head to tail, with the knife held parallel to the working surface. The cutting edge of the knife should ride along the spine. This cut is made in one continuous stroke, and it leaves the ribs in the removed fillet. The process is repeated on the other side, separating the remaining fillet from the spinal column and the caudal fin. A thin flexible knife can then be inserted just under the ribs to free them from the fillet.

#### *Skinning:*

Once the fillet is free of the body, lay it skin side down on the work surface. Beginning at the tail, insert the blade between the skin and meat, with the blade angled slightly towards the skin. In one continuous motion, while holding the skin at the tip of the tail, sweep the knife through the fillet, keeping tension on the skin.

#### *Pin bones:*

Pin bones are very small, rib-like structures found radiating out from the spine. If a fillet is laid skin-side down, they point upwards at an approximately 45 degree angle at the head end and rotate upwards to approximately 90° near the dorsal fin area. Whether the "J" or "V" cut is used, the best recovery will be obtained if the knife cuts rotate with the change in pin bone angle.

A "J" style cut begins at the head end of the fillet and continues to just behind the dorsal fin area. The pin bones are left in the top loin portion. This cut can reduce the fillet's weight by as much as 40%.

A "V" style cut removes the strip of meat which contains the bones, leaving the loin portion on the fillet. The recovery is increased with the "V" cut, but so is the possibility of defects due to cut bones.

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Another method of pin bone removal is to pull them. At this time, I have not heard of an effective mechanical removal system.

*Tips:*

Have a lead person on the processing floor rotating through the crew at all times, giving five minute breaks to the filleters. This will keep an experienced person circulating and demonstrating good technique.

Never put a new filleter on the floor until trained by a lead person.

It cannot be over-emphasized that the key to the entire operation is a sharp knife. If the level of processing allows, hire a person whose only job is to sharpen knives.

Do not allow a steel on the processing floor. An experienced person may gain a little extended life on a blade, but the waste of time does not justify its use. An inexperienced person will ruin the edge on the first pass.

At every break, account for each knife and be certain that the blade is intact.

Reject work back to the processing line. Do not establish a second position to rework poor products.

Good workmanship is "A" grade. An "A" is 95% right, not 100%.

Tell the crew when they are doing well. That will be 95% of the time. Then, when they are shown defects, they will not take criticism personally.

When using the J-cut method, the graders should be able to tell if the cut is being properly made by the shape of the resulting bottom portion.

Manual inspection, running the gloved hand over the fillet as it goes by on a belt, skin side down, is the surest way to detect bones.

#### 4. TRIMMING

Trimming is the reworking of products which have not been adequately prepared by the heading, gutting, filleting, or skinning machinery. The reworking is intended to bring the fillet back to an acceptable level of defects.

Because there is normal variability in fish size, freshness, and level of internal defects, processing machinery must be readjusted periodically for a new average fish. This is because any fish which is not average, by the machine's standard, will receive a machinery caused defect when it is made average. The defect will be corrected by trimmers, resulting in reduction of potential recovery. If the equipment employed is "smart" and can adjust to a wider range of average fish, the defect rate will be reduced, recovery will improve, and fewer trimmers will be needed.

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### *Inspection:*

With conventional processing machinery, a certain number of average fish will be produced which do not require trimming. If the number of acceptable fish increases to a high enough level, a grader can be used prior to the trimming table. This position high-grades or diverts acceptable fillets around the trim table.

If the high-grade position is not used, the potential recovery will be reduced. Trimmers generally bring a defective fillet back to near perfect condition. In so doing, the fillet is trimmed past the point of acceptable defects. Even if the fillet is acceptable, an inexperienced trimmer will most likely do something to it, lowering its recovery.

The high-grade position can identify a consistently reproduced machine defect. Once a recurring defect is identified, the unit should be adjusted or repaired. Unfortunately, in moment to moment decisions on the production floor, the tendency is to cure small problems by throwing more people at the trim tables rather than isolating and correcting defects.

Another way to improve productivity is to ask why a person is doing a particular task and to avoid that step.

### *Trimming:*

There are two factors which affect trimming. One is training, and the other is using a properly designed and sharp knife suitable for the species. The best training policy is to require new personnel to be trained, one-on-one, by a supervisor or lead person before they go on the line. If they are not trained this way, they train themselves by observing the person next to them. From time to time, the lead person should trim next to the new person to reaffirm what good work looks like. The new employees should be given a reasonable production goal so they know when they are performing at an acceptable level.

Trimming differs from filleting in that it does not require as much effort. Because bones are not being cut, the knife can be loosely held, enabling the trimmer to make a shaving stroke. In fact, from the standpoint of recovery, perpendicular cutting should be avoided as much as possible.

The grip which allows greatest freedom of movement is to hold the knife loosely with the thumb and first two fingers. This grip keeps the wrist more relaxed, allowing better manipulation of the blade. The knife should not be put down, because this slows the operation. The style and flexibility of the blade selected depends on the species of fish being processed. Trial and error on each kind of fish is the best way to select knives.

Each trimmer should have at least two knives, one being sharpened, and one in use. If the operation is large enough, a person should be employed specifically to attend to the knives. The knives should be checked at each sharpening to assure the blade is intact. The tip of the knife should be ground so it has a 1/8-inch round tip. This will help keep the tip from breaking, is safer, and does not affect the usability or productivity of the knife.

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The trimming operation always seems to shift in one of two directions. The first scenario is increased production with careless workmanship, sacrificing both quality and recovery; the second is improved workmanship to the point that quality is better than the specifications required, and productivity is reduced. The best way to avoid either of these situations is to have a fillet per minute goal. If it is a reasonable processing average, the table line will be in equilibrium.

*Graders:*

There should be a grading position at the end of each trim table. The grader does not have a knife and rejects defects back to the table. Graders should be trained in the same manner as trimmers and function independently from the quality control audit function.

*Grade Standards:*

Grade standards are established in two ways. They either are written by the consumer as in the case of the "United States Grade Standards" or by the company's marketing department. It is the responsibility of the production graders and quality assurances staff to assure the grade standard is followed. One method is to establish a sampling procedure for outgoing quality. One of the best sampling systems available comes from the military and is designated "Mil-Std-105D."

*Tips:*

There are two key elements to a successful operation. The first is a lead person who is on the production floor during processing. The second is a production grading and quality control staff which audits the machinery's and trimmer's workmanship. Without these elements, one of two situations can develop. Either low quality workmanship will cause the product to be rejected or discounted, or the quality will exceed the standard and the volume will decrease.

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## STATISTICAL QUALITY CONTROL

### 1. MEASUREMENTS OF THE POPULATION'S WIDTH

A population's width, or distribution of its individual members, may be expressed in a variety of ways. The range is the easiest population parameter to compute, but it also gives the least statistical information. The range is most valid when used with small sample sizes. Because it uses the population's data extremes, it does not give an accurate view of the distribution in larger groups.

It is calculated by subtracting the least value in the population from the greatest.

Example:

Data points 2, 5, 9, 12, 15, 18

$$18 - 2 = 16$$

$$\text{Range} = 16$$

Standard deviation:

The standard deviation gives a better view of the population's distribution and yields a value which is useful in further calculations. It is also a value which is not greatly affected by individual values.

The standard deviation is calculated by taking the square root of the variance. It is a value based on all the data and gives a relatively unbiased view of the entire population.

The calculation begins by first finding the mean value.

Example:

Data points 2, 5, 9, 12, 15, 18

$$\text{Sum} = 2 + 5 + 9 + 12 + 15 + 18 = 61$$

$$\text{Mean} = 61 / 6 = 10.17$$

Next, the variance is calculated by subtracting the mean from each value and squaring the result. This is always a positive value.

$$(2 - 10.17) = -6.75$$

$$(5 - 10.17) = -5.17$$

$$(9 - 10.17) = -1.17$$

$$(12 - 10.17) = 1.83$$

$$(15 - 10.17) = 4.83$$

$$(18 - 10.17) = 7.83$$

Next, total the values.

$$\text{Sum of } (X - \text{Mean})^2 = 182.84$$

Next, divide the sum of the squares of the differences by one less than the number in the population. This will yield a better result for small populations.

$$N - 1 = 6 - 1 = 5$$

$$\text{Variance} = 182.84 / 5 = 36.57$$

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Finally, the standard deviation is obtained by taking the square root of the variance.

$$\text{Standard Deviation} = \text{Square Root of Variance} = 6.05$$

One standard deviation on either side of the mean will contain 68.3% of the population. Two standard deviations on either side of the mean will contain 95.4% of the population, and three standard deviations will contain 99.7% of the population.

Note: A standard deviation calculation produces a value which is based on the mean and an assumption about the population. The assumption is that the population is symmetrical around the mean. While this assumption is valid on a normally distributed population, it should not be assumed that all populations are normally distributed.

## 2. MEASUREMENTS OF CENTRAL TENDENCY, MEAN, MEDIAN, MODE

One of the first concepts encountered in statistics is that of the central tendency of data. Once enough information or data are collected on a population, a single value begins to occur more frequently than any other. If the data are presented in the form of a histogram graph, the closer one approaches the most frequent value, the more items fall under that histogram distribution. Statisticians generally refer to the central value as the average and the population as being distributed around the value.

There are several methods for evaluating the central tendency of data. The one most often used is the arithmetic mean due to its ease of calculation. In addition to the mean, though, are the median, mode, harmonic mean, and geometric mean.

This section will deal with how the mathematical manipulations of data are performed to produce a central value. The following sections will go into evaluating the populations' distribution around the central value.

### *The Mean:*

The mean is typically the first piece of statistical information extracted from group of sample values. It is calculated by adding all the values and dividing the sum by the number of values. This average is denoted by the symbol "X."

Example:

Fish Fillet

Weight

4.3 oz

4.0

3.8

4.7

4.2

21.0 oz

21.0 oz / 5 fillets = 4.2 oz / fillet

Notice that the terms "ounces" and "fillets" were left in during the calculation and were carried through to the final answer. This technique can be used in all math and is a good check of the process. If the answer ended with 0.238 fillets per ounce, a calculating error has occurred. Note the words can also cancel the same as numbers when they occur in both numerator and denominator. Keep in mind that when calculating the arithmetic mean, the data points at the high and low extremes may not be valid and should be rejected because they are not representative of the population. If these outlying values were to be used in the calculation, they would lead to an erroneous value. There are statistical tests which can be applied to determine the significance of an extreme data point if there is reasonable doubt as to its validity.

#### *Weighted Average:*

A weighted average calculation places the same importance on all data points. It is calculated like the mean except that the data points are multiplied by a normalizing value.

#### *Example:*

During a processing day, we frequently sampled fish fillets and obtained an overall average for the day; then we continued to do this for five consecutive days (see Fig. 3). Also, the number of fish processed for each day differed. At the end of five production days, we had the following data:

Fillet Weight	Fillets Produced
4.6 oz	8954
4.0	6102
4.2	7491
3.8	1350
4.4	8001

On the fourth day of production, the fish were considered too small to use in the filleting operation, and the rest were sent to the can line.

If we take a straight arithmetic mean of the five days' production, the average fillet weight for the production period is 4.20 ounces. If a weighted average is used, we obtain the following information:

Production		
Fillet Weight	Fillets Produced	Weight
4.6 oz.	8954	41188 oz.
4.0 oz.	6102	24408 oz.
4.2 oz.	7491	31462 oz.
3.8 oz.	1350	5130 oz.
4.4 oz.	<u>8001</u>	<u>35204 oz.</u>
Totals	31898 fillets	137392 oz.

137392 oz. / 31898 fillets = 4.31 oz / fillet Average Weight

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If the total number of ounces is divided by the total number of fillets produced, the average fillet weight is 4.31 ounces.

It is apparent from a quick review of the data (without a calculator) that if we walked into the freezer and randomly selected one hundred fillets over the five production days, the value of 4.31 ounces would be reasonable.

If the facility were given bonuses for product over a given average weight and penalized if the fillet dropped below another specified average weight, you can quickly see the value of a weighted average.

#### *Median:*

If all the data are organized in an array (ascending or descending values), the middle value is the median. If there is no middle value, then the mean is taken for the two middle values. The median calculation will reduce the influence of values at the extremes which may not be representative data.

#### *Mode:*

The mode is simply the most frequently occurring value. If two values occur with the same frequency, the data are bimodal.

If there are significant differences between the mean, median, and mode, something (usually found between the fish dock and the van dock) is skewing the process.

### *3. Weight Control and Z Scores*

This section will demonstrate Z Score calculations and how they are used to set control limits and target weights for a portion packaging line. The same procedures can be used to establish a weight control program for any product. The example uses data collected from a canning line, but it could have just as easily come from a line producing portion packed fillets. To continue in this section requires familiarity with the procedures used to calculate the mean and standard deviation for a population.

To control product weight, one must know the processing line's portioning capabilities based on past performance. The past performance essentially gives a reference point or a point of departure. Assessing where the line is is critical to determining how to get it where it should be. From the line's past performance, one important piece of statistical information is collected, the standard deviation. The standard deviation is used in calculating the target weight and control limits by using Z scores. Once the standard deviation has been calculated, it can be used to position the population wherever desired. The method used to obtain the standard deviation affects the level of control that can be achieved. Two methods of calculation are included to demonstrate the machine's actual ability to reproduce a desired weight.

The target weight is exactly what its name implies. It represents the exact mathematical value which, if obtained, will yield the best possible product weight. The control limits represent the rings around the bull's-eye (target weight). They give an indication of how far from the mark the value has strayed.

### *Standard Deviation:*

The method most often used to calculate a standard deviation is to combine all the individual sample weights, and treat them as one large value. There is another less frequently used procedure (the averaging method) which divides the large population into subgroups and calculates a standard deviation for each. The average is then taken of the sub-group standard deviations.

As an example during a processing day, ten groups of ten samples were collected. When they were combined into a single group of 100 items, the standard deviation was .285 ounces. When they were treated as ten separate populations and then averaged, the standard deviation was .269 ounces. The large population standard deviation, which disregards time, is greater than the average standard deviation of the individual ten can samples which takes the condition of the moment into account. This indicates that, from moment to moment, the processing line is capable of producing product within a relatively narrow weight band. Even though the average value wanders due to fish quality and changing machine tolerances, the range of weights remains relatively constant.

When the averaging method is used to obtain a standard deviation, product weight's apparent wandering is de-emphasized. When the day's production is calculated as a large single population, the heaviest and lightest values are combined, as if both weights occurred at approximately the same time, and the wandering is not apparent. While both methods of calculating the standard deviation are technically correct, the information obtained from the averaging technique allows greater control over the product's weight because it gives a better picture of the operating conditions.

### *Control Limits:*

Control limits have upper and lower boundaries denoted by the symbols "UCL" and "LCL." They form a pass band which contains the target weight. When a sample's average weight falls between the UCL and LCL, the process is under control. If the average falls outside the pass band, corrective action is required to bring the process back under control.

### *Example:*

The easiest way to demonstrate the utility of the weight control concept is by example. To do this, a weight control program will be formulated for a can line which produces one pound cans (15.50 ounces). The data were collected using an over/under scale with a tare set at 15.50 ounces over a 41 production day period. Each day had a minimum of 120 individual samples collected.

Can Line Data  
average std. dev.

Day 1	0438 oz	0.278 oz.	Day 1 (Cont.)	0.324	0.244
	0.305	0.298		0.395	0.265
	0.374	0.277		0.370	0.249
	0.121	0.266		0.464	0.258

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0.314	0.281		0.373	0.251
0.199	0.266		0.386	0.244
0.347	0.284		0.442	0.272
0.300	0.270		0.384	0.240
0.308	0.278		0.342	0.259
0.302	0.277		0.420	0.281
0.358	0.292		0.432	0.241
0.403	0.324		0.392	0.269
0.467	0.254		0.355	0.252
0.341	0.298		0.388	0.260
0.347	0.261		0.364	0.292
0.254	0.246		0.408	0.225
0.331	0.304		0.222	0.278
0.395	0.277		0.212	0.261
0.286	0.256		0.355	0.267
0.450	0.252			
0.406	0.257	average	0.355	0.269
0.403	0.251	std.dev.		0.075

The grand average weight for the 41 production days is 15.50 + 0.355 ounces or 15.855 ounces. The standard deviation of the means is 0.075 ounces. The average standard deviations of the individual ten can samples for the 41 days is 0.269 ounces.

By using the one pound can lines past performance data, the target weight can be established as follows:

First, a decision is made as to how much of the product will be allowed below the label weight. For this example, 10% of the product will be allowed to fall below the label statement (or 90% of the product to fall above the label statement).

Referring to a table of Z scores, the value for 10% is obtained and plugged into the formula.

$$Z\text{-score} = \frac{\text{Target wt.} - \text{Label wt.}}{\text{Standard Deviation}}$$

The "Z" for 10% of the curve is 1.28. The label weight is 15.50 ounces. The standard deviation from past performance is 0.269 ounces. The target weight is the unknown value.

$$1.28 = \frac{\text{Target weight} - 15.50 \text{ ounces}}{0.269}$$

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0.269

$$\text{Target weight} = (1.28 * 0.269) + 15.50$$

$$\text{Target weight} = 15.84 \text{ ounces}$$

The UCL and LCL are established using the mean's standard deviation. From past experience, it was established that, on the average, a target weight could be achieved 68% (one standard deviation) of the time if it was given a latitude of +/- .075 ounces. (If 95% confidence was required, it would be necessary to increase the width to two standard deviations on either side of the target or +/- 0.150 ounces.)

The accumulated information for the weight control program is:

Target weight	= 15.84 ounces
UCL	= 15.99
LCL	= 15.7
Green band range	= 15.92 to 15.76 (15.84 +/- 1 std.dev.)
Red lines	= 15.92 and 15.76

Based on past performance, if the line is under control, 99% of the cans should fall within a weight range no greater or less than three standard deviations (of the population, not the mean) from the 15.84 ounce mark. Also, a can should not be produced which weighs more than 16.65 ounces or less than 15.03 ounces.

#### *Conclusions:*

The obvious advantage of the weight control system is that more product of greater uniformity can be packed with the same quantity of fish when a processing line is under control.

#### **4. ACCEPTABLE QUALITY LEVEL**

An acceptable quality level is a value placed on the maximum allowable number of defects or defectives per one hundred units of production. It represents an average quality level of the manufactured products during a production run. An AQL can also be thought of as a numerical scale which expresses the quality of a lot instead of an unqualified good or bad statement.

The AQL represents an average value of the quality level in all the outgoing lots. Since every lot is not sampled, there is a risk that unacceptable lots may be processed. There is also a risk that the randomly selected sample is not representative of the entire lot.

The sampling risk can best be explained by example:

Into a one gallon jar, empty four one-pound bags of black beans. Next, add a handful of white beans to the jar. The jar now contains a fixed population of black and white beans in an unknown ratio.

Just by observation, there appear to be approximately 1% white beans in the jar. To determine what the actual ratio is, the population could be 100% inspected or sampled by a sub-lot system. Because there appear to be about 3000 beans in the

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jar and due to time constraints, the decision is made to sample the population instead of perform a 100% inspection.

Using a sample procedure which will be discussed later (Mil.-Std.-105D), it is decided to collect a random sample of 125 beans. If the sample contains three white beans or less, we will accept the lot as having no more than 1% white beans. If the sample contains four or more white beans, we will reject the the lot for having more than 1% white beans. (This experiment is known as the Flashour Bean Count.)

As a side note in this bean test, there is only an accept or reject decision for each bean based on color. In some inspection situations, a single item may have multiple evaluations, and each fault would be classified as a defect.

The random sample contained 122 black and three white beans. The lot was accepted on the basis of one evaluation.

Probability and statistics tell us there is a chance that we will select a sample which does not correspond to the actual population. Also, the more often we sample the lot, the more we will know about it. It would stand to reason that as the test is increased from a single sample to a large number of samples the population is coming closer to 100% inspection.

In a sampling procedure, there is always a risk of drawing a random but non-representative sample. The risk the manufacturer takes is that the lot is actually of acceptable quality, but the random sample indicates its unacceptable. The risk the consumer takes is that the lot will be accepted when it should be rejected. The AQL in the sample plan gives the processor an additional tool for monitoring production. If the outgoing quality is meeting the AQL, the lots will be accepted with 0.95 probability or 95% assurance of acceptance. The consumer's risk of receiving a lot falling below the AQL in quality has a probability of 0.10 or 10% assurance.

#### THE RISKS CAN BE DISPLAYED GRAPHICALLY AS FOLLOWS

There is no simple method to decrease the risk incurred by sample plans. The AQL can be given a smaller value which will decrease the risk, but the sample size will become larger. The tightening could continue until 100% evaluation had occurred. At that point, it is 100% inspection rather than a sampling plan. (If you would like to pursue sampling theory further, review null hypotheses in a statistics text.)

Major defects such as droops indicate potential for critical defects, usually problems in the manufacturing process. An excessive number of defects indicates problems with the line or materials. The minor defects such as dents, dirty cans and the like also become a problem with they reach a high frequency. At some point, the can will look like a product on which you would not want your label.

The question of how to select an AQL can be the most difficult part of devising a sample plan. Minor defects are relatively insignificant from a public health standpoint, and an AQL value can be easily assigned. A major defect may carry much greater importance from a safety standpoint, and its AQL should be considered very carefully. The critical defect's AQL is a value for which nobody

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wants responsibility. By definition, a critical defect is one which will render the item unusable or unsafe to the end user. Also, the acceptable quality level implies a value which should not be exceeded. When the two terms are combined, you have placed a minimum acceptable value for a defect which has the potential to be unsafe. This is obviously a no-win situation for the person who assigned the AQL to the item with potential to harm someone.

Another approach is to set the AQL below the desired processing average. Then if a defect is detected, track down the problem and fix it. This is where the incidental and cosmetic categories are helpful. None of the approaches implies that one should accept defects just because a certain number is allotted in an AQL. Generally speaking, the farther away from the plant a problem is resolved, the greater the cost.

By reviewing an OC chart for the selected AQL and sample size, it is possible to determine if the sample plan will discriminate adequately between lots. The working AQL may have to be tightened to assure that the outgoing quality level meets purchaser specifications.

Notes: In a text entitled, *"Control of Critical Points in Food Processes,"* a footnote indicates that "in fact, AQL's are assigned by the AQL Fairy: Put the defect in question under your pillow, and the AQL Fairy will take it away during the night and replace it with an AQL." Another selection method could be to use an established AQL such as one developed by the United States Department of Defense. Using one of these methods gives you an out; if something gets by, you can blame it on the Fairy or the government. In fact, though, you ultimately bear responsibility.

#### 5. AQL'S AND SAMPLING

A product's specification AQL might state that the minimum weight of a salmon fillet may not be less than four ounces. With this single characteristic requirement, the sample item fails if the weight requirement is not met.

An AQL may be an expression of the total defects in a lot without regard to the number of defects on a single item. For example, a salmon fillet may be assigned an AQL of 1.0 for bruising where a bruise is defined as a bloody mark the size of a dime. If a single fillet has three unacceptable bruises, each becomes a defect and is part of the total number of allowable defects in the lot. If there is not a total number of allowable bruises per fillet in the specification, the fillet does not fail.

A sample plan may operate with multiple AQL's which reflect the seriousness of the defect. It may be very liberal with minor or cosmetic defects, while any major or critical defects fail a lot.

A definition or classification of defects is given in Mil-Std-105D. Although the standard was developed for use by the military section, it was meant to be applied to industry.

The standard defines a critical defect as one which renders the item unusable for its end purpose, or unsafe to the end user. A major defect is less serious, but has the potential of becoming critical. The least serious are minor defects which do not render the item unusable, but are not within product specifications.

Cosmetic or insignificant defects are useful classifications for monitoring purposes within the plant. They frequently help isolate potential problems.

*Canning* gives a good example of how to apply AQL's and defect classifications. For example, a hole in a can is considered to be a critical defect. It is of such concern that manufacturers employ an in-line double dud detector to inspect 100% of the cans twice for deflection. The nature of some products is to form a seal or patch over a hole. The hole will leak so slowly it may not be detected on the first pass through the dud detector. The can could be tested as many as three more times before it is on the shelf.

The lot receives 100% mechanical sampling each time it passes through the dud detector. By the third pass, the defective can has received 300% inspection. In spite of such intense sampling, a can with a hole can get through the inspection process. Knowing this, the issue becomes how small an AQL can be achieved under the processing conditions to insure the greatest product reliability and still allow the manufacturer to produce product economically.

#### 6. OPERATING CHARACTERISTIC CURVE

An operating characteristic, abbreviated OC, is a graphic presentation of how a sample plan can be expected to perform statistically. The vertical axis represents the probability of accepting a lot. The horizontal axis represents the quality of the submitted lot.

The figure below shows an ideal OC curve for the case where all lots with 1.5% defects or less will be accepted, and all lots having a quality level greater than 1.5% defective will be rejected. It is noted that all lots which have 1.5% or less defects have a probability of 1.0 or 100% certainty of being accepted, while all lots having greater than 1.5% defects have a probability of 0.0 or 0% certainty of being accepted.

##### AQL'

In reality, no sampling plan exists that can discriminate with 100% accuracy between acceptable and unacceptable lots. There is always a risk that a good lot (a lot with the acceptable amount of defects) will be rejected. This is referred to as an alpha risk, or as the manufacturer's risk. Conversely, there is always a risk that a bad lot (a lot with more than the predetermined number of defects) will be accepted. This is referred to as the beta risk, or the consumer's risk. The operating characteristics and the associated risks of a sample plan can best be demonstrated by using the curve produced by a sampling scheme.

If an inspection were to be made of a lot containing 10,000 items, the sample plan would require that the evaluation of 200 items be selected at random. This sample size would provide a normal inspection at an AQL of 1.5. If the lot contains seven or fewer total defects, it is passed as having an AQL. Eight or more defects will cause the lot to be rejected.

Referring to the graph and the tabulated values taken from the Standard, a lot which does not exceed the defect rate has a probability greater than 99% of being accepted (or a probability of less than 1% of being rejected).

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AQL	Percent Chance of Accepting
1.45	99.0
1.99	95.0
2.33	90.0
2.98	75.0
3.84	50.0
4.84	25.0
5.89	10.0
6.57	5.0
8.00	1.0

What may not be apparent at first glance is the 50% chance (or probability of 0.5) that a lot with an AQL of 3.84 will be accepted using this sample plan. Also, a lot which exceeds the 1.50 AQL has a 1% chance of being rejected even though the AQL is acceptable).

By reviewing an OC chart for the selected AQL and sample size, it is possible to determine if the sample plan will adequately discriminate between lots. It may be that in order to assure that the outgoing quality level meets the purchaser's specifications, the working AQL will have to exceed the outgoing AQL.

#### *7. Sampling Plan*

The sampling program presented here is the one used by the United States Department of Defense. It is designated MIL-STD-105D and is a scheme designed as an acceptance sampling program by attributes. It can also be found in a slightly modified form as ANSI Standard Z1.4 (the American National Standards Institute's form) or ISO Std. 2859 (the International Organization of Standardizations' form).

I recommend its use for a number of reasons. If you intend to sell a product to the U.S. Government or any organization required to purchase by U.S. Grade standards, you will most likely have it applied to your product. It is a ready-made plan which has withstood court tests. If the stated outgoing quality level of your product is ever questioned, you will not have to justify your sample plan, only your data. It is extremely easy to use and statistically sound. Best of all, it is free.

The plan essentially involves evaluating a randomly selected sample of a lot and determining if the particular item is defective based on certain selected attributes. The heart of the plan is the acceptable quality level (AQL) which establishes the number and severity of defects.

If the plan is used in its entirety, it allows for a combination of sample plans and different levels of screening. This section will deal with only the basic application which should be more than adequate for general purpose uses.

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From a technical standpoint unless the sample plan developed in the facility allows for switching from normal to tightened inspection, it cannot be called a MIL-STD-105D plan. While switching is important in an official application of the scheme, it may not be necessary for routine in-plant production evaluations. The following example, therefore, will be centered on Inspection Level II which is designated as normal without provisions for switching.

There are four steps to using 105D:

1. determine the AQL;
2. determine the lot size;
3. enter Table I for the Sample Size Code Letter;
4. and enter Table II-A for Accept & Reject levels.

To demonstrate how the plan works, let us consider the production of fillets. For the sake of simplicity, let us assume that a bone in a fillet is the only defect which is critical (or nonconforming). Any other defect will be listed as major. The critical defect will be assigned an AQL of 0.65, and the majors will receive a 6.5 AQL.

Because the line runs continuously, the product must be broken into lots. Otherwise, the day's production would become one large lot. For the ease of sampling, an hour's run will be considered a lot which generally contains 1,500 fillets.

In Table I of the sample plan, we find 1,500 is between 1,201 and 3,200. Going across the page to the column "General Inspections Level II," the letter "K" is found.

Next, we go to Table II-A, the "Master Table for Normal Inspection of Single Sampling," and we move down the sample size code letters until we arrive at "K." Across from "K," we find the sample size 125. Continuing across the line, we find the accept number is 14 for an AQL of 6.5, and the reject number is 15. For an AQL of 0.65, the accept value is two, and the reject value is three.

This is all the information required to implement the plan. The next step is to make a form with the appropriate columns for sample times, major defects, critical defects, and the inspector's initials, then to begin inspecting.

While what has been presented is adequate for a general sample plan, I would recommend that the quality assurance manager obtain a complete copy of the standard.

Each sample size and AQL has an operating characteristic which indicates its reliability. A manager should have working knowledge of the plan's switching procedures and operational characteristics to know the reliability of the particular plan employed.

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## Sanitation

### *Overview*

A facilities sanitation program should be designed around public health theory and managed by an individual who has training and experience in the field. The sanitation department should oversee two components of the plant's operation. The first of these is the processing area and related equipment. The second area is the integrity of raw products, ingredients, packaging materials and finished products.

When a facility processes food for public consumption, local, state and federal governments will naturally become involved. The manager of sanitation must review the literature available from these agencies and commit the majority of it to memory. In a food processing facility, it is management's responsibility to have a working knowledge of governing regulations for the industry.

The government inspector's main concern is public health. The sanitation manager should keep in mind that the regulations set the minimum sanitation requirements for food processing facilities. The two key words in the regulations are "wholesome" and "unadulterated," and it is the duty of the inspector to guard against violations. Government requirements often fall short of the company philosophy and should not be considered the company's standards.

In Alaska, two agencies, the Federal Food and Drug Administration and the Alaska Department of Environmental Conservation, regulate food processing. The FDA inspectors base facility evaluations on adherence to the umbrella "Good Manufacturing Principles" found in the Code of Federal Regulations, Chapter 21, part 110. The ADEC inspectors use State of Alaska Fish Inspection Regulations found in 18 AAC 34. One additional inspection service may be encountered if you supply the military; the Army Veterinarian Corps uses Fed-Std-369 or Mil-Std-1483A.

Industry support groups have developed guidelines or requirements for their members, but have no enforcement power other than expulsion from associations. Voluntary organizations and public service agencies can furnish valuable information on plant maintenance. Their concerns are directed more towards quality than wholesomeness. Information is available from the Department of Commerce and Economic Development, the Alaska Seafood Marketing Institute, the Marine Advisory Program, the National Food Processor's Association, the National Marine Fisheries Service, and the United States Department of Agriculture, to name but a few.

### *Policy and Procedure*

Management must instill pride in the product through its supervisors' actions. It cannot be over emphasized that pride in the company and its products comes from the top down. This brings us to the point of who is actually responsible for maintaining the plant and dividing assignments among workers.

First, the production department is responsible for all phases of production. This obviously requires putting out a finished product which meets the company standards. What may be less apparent is the need for cleanup after processing.

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A new employee should be instructed in the company's policies and procedures by means of a general orientation before the person is allowed to enter the production area. Once the employee has received a job assignment, the lead person or foreman in the assigned work area should go over the specifics of the particular job and reinforce what has been discussed in orientation. The next step should be reinforcing sanitary practices, hygiene, and outlining what the company considers to be acceptable dress.

In the overall production scheme, there should be an insurance policy (or assurance policy). This function is generally carried out by at least one and sometimes three groups. These are the sanitarians, quality control, and quality assurance groups.

The sanitarians, like quality control and quality assurance personnel, perform an auditing function. They should find the deficiencies in the processing system instead of the health inspectors. If deficiencies are found, it is their responsibility to report them to the responsible party. If necessary, the policy and procedures manuals should be updated.

When division of responsibilities and company product standards are well understood, there is generally a good working relationship between the in-plant inspection and production groups.

Unfortunately for the sanitarian if the overall plant operation is not understood he will be viewed as the individual who kept a line from starting on time. In reality, the clean-up crew did not do a proper job, and production was willing to use dirty equipment.

#### *Cleaning and Sanitizing*

Cleaning and sanitizing a processing area is a rather straightforward procedure. First, determine the composition of the processing waste. Next, select the products and application method which will best remove the processing waste. After the equipment has been cleaned, it must be rinsed and sanitized. Questions regarding compatibility of chemicals with equipment or specific cleaning/sanitizing requirements can best be answered by the companies supplying the products.

While the selection of the proper equipment and chemicals and obtaining methods and procedures for their use are certainly important to the overall sanitation program, they are probably the easiest parts of developing a good sanitation program. Getting the information to the employees is the critical step.

The plant sanitarian and clean-up crew foreman should occasionally inspect the plant together. A narrative of the inspections findings generally is ineffective in transferring information back to the clean-up crew. Instead, use a form that pictorially represents the processing line and pinpoints locations of the deficiencies. Periodically check the equipment

and product for contaminants using micro biologic and chemical analyses.

Finally, one last concept sometimes encountered in plant sanitation is "clean in place" equipment. I am personally against it in the general case. Food processing equipment should be designed and constructed in such a way that it

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can be easily disassembled, cleaned and sanitized. Granted, it may be possible to effectively "clean in place" a new piece of

equipment if the instructions are followed, but, as the unit becomes worn, the seals and welds will have a tendency to fail. By disassembling the unit to clean it, you also have an opportunity to inspect it.

I have found four general principles which have served the processor in good stead:

1. if you won't feed it to your family, reject it;
2. if you don't want to see it on the six-o'clock news, don't do it;
3. you can tell a great deal about the quality of the product and plant's workmanship by looking at the work space; and
4. the person who gets paid for the job is responsible for it.

#### *General Information*

##### The Water Supply:

All water which comes in contact with the product being processed should meet the same bacteriological standards as drinking water. To achieve this, in-plant chlorination systems (in addition to the municipal system) should be employed. For best results in dealing with the slime-producing bacteria (*Pseudomonas*, *Achromobacter*, or *Alcaligenes*) associated with

flumes, conveyors, and belts, a residual chlorine content from five to seven parts per million is generally recommended. This concentration is what remains after the break point (the point where the chlorine demand has been satisfied). The water supply to the ice-making equipment should be treated as part of the same system.

If the facility is reusing water from a waste water treatment system, there are additional requirements which are beyond the scope of this pamphlet. It is the responsibility of the processor to know and to fulfill these requirements.

##### Incoming raw materials:

To keep spoilage at a minimum, the incoming product must be screened for wholesomeness and should be graded for quality. Any material which does not meet the minimum grade standard should be rejected and disposed of as soon as possible to avoid additional contamination of raw materials or the processing area and equipment.

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### Ingredients:

An ingredient is anything which is added to the product. If additives are stored, a periodic inspection of the warehouse is necessary to assure that the stored products are not contaminated by birds, other animals, insects, leaking plumbing, standing water, condensation or anything else which would make the material unfit for its intended use. If contaminated material is found, remove or discard it immediately.

### Packaging materials:

The finished product can be contaminated by its packaging material at the end of production as easily as it can be in the initial rinse water. In fact, the federal regulations regarding adulteration are quite specific and do not differentiate according to the source. Therefore, the same inspection procedures used in ingredients should be implemented for container storage.

If cardboard boxes are assembled in advance of production, they should be stored in a way that assures no foreign material can find its way into the boxes. The box liners should be given special attention since they will come in direct contact with the product.

### *Equipment Cleaning*

#### Rinse:

Equipment should be rinsed with high pressure cool water prior to cleaning. This will help remove the protein residue instead of cooking it onto the equipment with a hot water rinse.

#### Detergents:

The reason for cleaning processing equipment is to remove the bacterial food source. The products used are detergents, generally in conjunction with additives. Essentially, a detergent is a wetting agent which helps emulsify or saponify fats. Once the residues have been acted upon by the detergent, they can be removed with water.

Detergents may be alkaline compounds such as lye, trisodium phosphate, polyphosphates, soda ash, or sodium metasilicate. Other detergents may be acid-based compounds such as hydroxyacetic acid, levulinic acid, citric acid, tartaric acid, and gluconic acid. They can be based on positive ions (Na<sup>+</sup> or sodium) with organic ends in the sulfonates. They can be negative ions (Cl<sup>-</sup> or chloride) with organic ends like the quaternary ammonium compounds. Also included are the non-ionic compounds in the polyether alcohol group.

Some detergent compounds' effectiveness can be increased if they are applied as foams. The foam gives the cleansers a longer contact time with the equipment and helps float the waste off the equipment.

In some instances, the accumulated material on the processing equipment is composed of soluble minerals. If this is the case, a water conditional may be required.

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### Sanitizers:

Sanitizers kill microorganisms. Their effectiveness is dependent on how well the equipment is cleaned, the temperature at which they are being applied, and their concentration. Some of the most common sanitizers are

chlorine and iodine and quaternary ammonium compounds.

The advantages of using a chlorine compound over other sanitizers are that it is inexpensive, it has excellent germicidal action and will kill most bacteria and molds, it is rapid acting and requires a short contact time, it does not remain on equipment and therefore does not require a final rinse, and it has an easily detected odor. Its disadvantages are that it can corrode and cause rusting, it is pH dependent, its effectiveness is quickly reduced by organic material, it can be hazardous to the respiratory system and cause skin irritation, and its concentration must be checked with test kits.

Factors which affect the disinfectant action of chlorine solutions are the temperature and pH of the solution, the concentration of the chlorine, and the amount of organic and inorganic matter in the water.

The temperature directly affects the solubility of the chlorine compound in water. Therefore, the hotter the solution, the more compound can be dissolved. While it then seems logical to get the water as hot as possible and make a very concentrated solution, in practice it does not work. The more hypochlorite that is added, the more the pH of the solution shifts, and the less effective is the germicidal action. Also, since part of the reaction produces chlorine gas, the hotter the solution, the more chlorine is driven off as gas.

Of the two factors, temperature and pH, pH is by far the more important. For best results, the solution should be between 6.0 and 7.0, and more than ample compound can be dissolved in water of 180 degrees F.

Chlorine gas does not have the same equilibrium reactions as hypochlorite, but the effect of temperature is the same. As the solution's temperature is increased, gas begins to boil off, and around 190 degrees F. the loss is significant.

#### Recommended Chlorine Concentrations

Free Residual	2 - 7 ppm
Clean-up Rinses	20 - 50 ppm
Hand & Foot Dips	200 ppm

Iodine will also kill most bacteria and molds. It is not corrosive, its color indicates its concentration and effectiveness, and it does not leave a residue. Its disadvantages are that its effectiveness is reduced by organic matter, and it is less effective at temperatures over 120 degrees F. and pH's greater than 6.0. If the iodine solution is stronger than 25 ppm, it must be followed with by a water rinse.